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MACHINERY
APRIL 1948
Vol. 54 No. 8

Buick's Dynaflow Drive Built to Aircraft Tolerances

An Outstanding Development in the Automotive Field, the Buick Dynaflow Transmission is a Precise Mechanism that Requires Close-Tolerance Manufacturing. Some Processes Developed to Meet the Unusual Problems Encountered in Producing This Unit Economically on a Mass-Production Basis are Described in This Article

By CHARLES H. WICK

SMOOTH and efficient flow of power over a wide range of speeds is automatically provided by the new Buick Dynaflow transmission. With this mechanism, which was described in February MACHINERY, page 176, the clutch pedal is eliminated, no shifting of gears being required.

Combining a fluid coupling with a hydraulic torque-converting unit, the Dynaflow is an outgrowth of the transmission employed on the "Hell-Cat" tank destroyer built by Buick during the war. The major components of the transmission include a torque converter; a planetary unit; an oil supply system; two pumps; a hydraulic control system; and an oil cooler.

Since parts of the transmission operate at pressures up to 200 pounds per square inch and at temperatures as high as 350 degrees F., close tolerances must be maintained to prevent leakage of the hydraulic fluid. Tolerances as close

as 0.0003 inch are specified for many of the parts.

The components of the torque converter, Fig. 1, namely the primary pump *A*, secondary pump *B*, primary stator *C*, secondary stator *D*, and turbine *E*, are thin-walled aluminum-alloy castings having integral vanes. The aluminum alloy used for these independent rotating members contains about 4 per cent silicon, 4 per cent copper, 0.45 per cent magnesium, a maximum of 1 per cent iron, 0.50 per cent lead, 0.60 per cent manganese, 0.50 per cent tin, 0.20 per cent each of titanium, chromium, and nickel, not more than 0.30 per cent of other impurities, and the remainder aluminum.

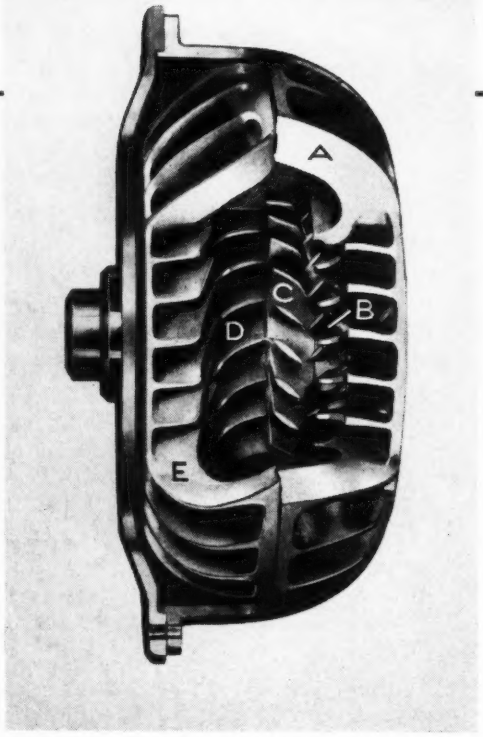


Fig. 1. The Torque Converter of the Dynaflow Transmission Contains Primary and Secondary Pumps A and B, Primary and Secondary Stators C and D, and Turbine E

These parts are cast to close tolerances by the Antioch plaster-mold technique. Plaster cores, which are disintegrated when the casting is completed, form the hydraulic oil passages between the vanes. The vanes have relatively sharp edges and a complex contour, similar to those employed in steam and jet engine turbine practice. The castings are solution heat-treated and aged to a Brinell hardness of about 85 before they are machined.

Relatively little machining is required on these precision aluminum-alloy parts because of the close tolerances to which they are cast. An interesting tooling set-up is employed, however, to finish several surfaces of the primary converter pump.

Twelve tools are mounted on a Heald Bore-Matic, Fig. 2, to turn, face, chamfer, and bore the pump castings. Prior to this operation, a flanged steel hub is secured to the casting with 17S-T aluminum-alloy rivets. The heads of these rivets are machined flush with the hub of the casting by one of the facing tools on the machine shown. Also, the edges of both inner and outer vanes are faced in the same operation.

The work is rotated at a cutting speed of 1000 surface feet per minute, and the various tools are fed hydraulically and by cam-actuated levers at the rate of 0.005 inch per revolution. About 1/32 inch of stock is removed from the several surfaces of the casting. The completed part is inspected on the multiple-gage fixture seen in the heading illustration.

Burrs formed in machining the aluminum castings are removed by blasting the parts with ground corncobs. Finished castings are tested for porosity by applying hydraulic oil under a pressure of 100 pounds per square inch. When leaks are found, the castings are impregnated with water glass. This is accomplished by placing them in a pressure tank heated to 250 degrees F. and exhausted to a vacuum of about 27 inches of mercury. The castings remain in the tank for two hours while impregnation takes place.

Planetary-gear carriers are made from SAE 5140 steel forgings. All surfaces of the forgings are rough-machined on a 16-inch Fay automatic lathe, Fig. 3. This lathe is equipped with a 50-H.P. motor.

Ten solid carbide tools are employed, four on the front forming bar and six on the rear. Round tool blanks are employed wherever possible, since they can be rotated slightly when the cutting edge has become dull, to present a sharp edge to the work. When the entire periphery has become dull, the tool can be turned upside down in its holder without affecting the set-up. In this way, about twelve sharp cutting edges can be employed on each tool before sharpening is required.

The maximum depth of cut for this operation is 7/32 inch, and the cutting speed varies from 125 surface feet per minute on the small diameter to 504 surface feet on the largest (5 inch) diameter. The tool is fed at the rate of 0.029 inch per revolution.

A rather unusual procedure in the production

of this part is to harden the forging before it is finish-machined. This is done to prevent subsequent distortion of the work, and insures that the accuracy maintained in the several operations is retained in the finished part. A hardness of from 32 to 36 Rockwell C is obtained in the heat-treating operation.

A similar Fay automatic lathe, equipped with fifteen solid carbide tools, is employed for finish-machining. The hardened forging is rotated at a maximum cutting speed of 618 surface feet per minute. The tools are fed at rates varying from 0.005 to 0.023 inch per revolution.

After drilling, reaming, tapping, hobbing, and rough-grinding, the periphery and face of the large-diameter end of the part are ground. The large diameter of the part is ground within a total tolerance of 0.0003 inch and the face is ground to as near a perfect flat as possible. The flat face is inspected by applying Prussian blue and rubbing the part on a master surface plate. Such precision is required to accurately align the part in a diaphragm chuck for subsequent boring of six pinion-shaft holes.

Before boring these holes, a rear member of the planetary-gear carrier is assembled to the part with dowels and bolts. Precision boring is accomplished on Ex-Cell-O machines, as shown in Fig. 4. Diameter and relative positions of the pinion-shaft holes are maintained within plus or minus 0.0002 inch.

Roughing and finishing solid-carbide tool bits are mounted on the same boring-bar. About 0.012 inch is removed from the diameter in roughing and 0.008 inch in finishing. A cutting speed of 300 surface feet per minute is maintained, and the tools are fed at the rate of 0.003 inch per revolution. Electrical heaters are located near the machines to insure a constant temperature, thus minimizing expansion and contraction which might affect the accuracy of the boring operation. It is intended to place these machines in an air-conditioned enclosure.

The two brake bands that actuate the planetary-gear arrangement for emergency low and reverse speeds are made from flat plates of SAE 5140 steel hardened to Rockwell 34 C. These plates, which are 9/16 inch thick by 1 3/4 inches wide, are rolled and welded to form rings about 6 inches in diameter.

After grinding both faces of the ring on a Besly double-disk grinder and rough-boring, the periphery is finished on a Sundstrand circular milling machine, as seen in Fig. 5. The helical-

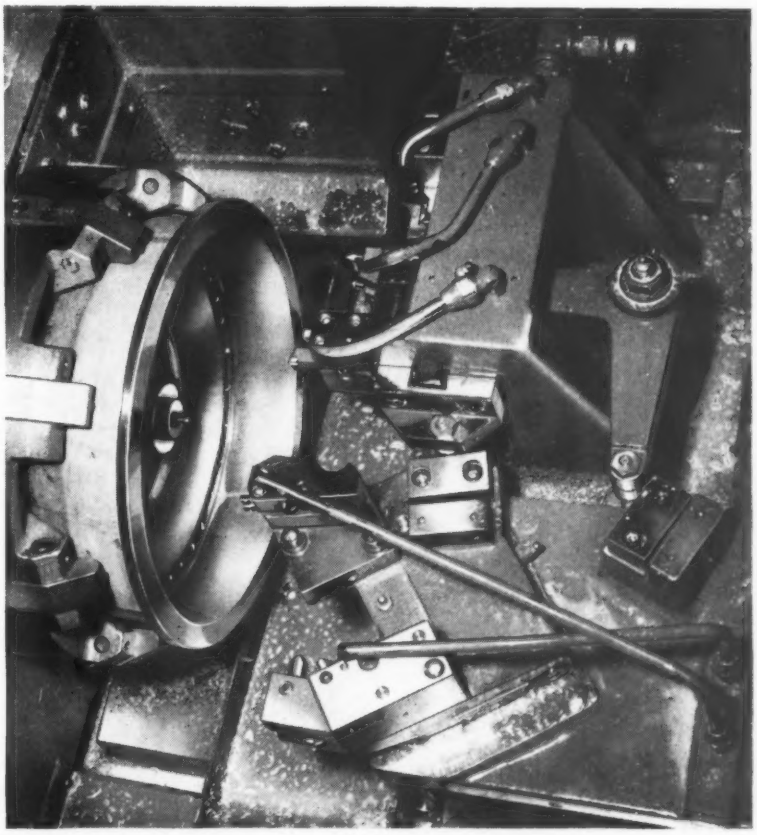


Fig. 2. Twelve Tools, Fed Hydraulically and by Cam-actuated Levers, are Employed on This Machine to Turn, Face, Chamfer, and Bore the Primary Converter Pump for the Dynaflow Transmission

Fig. 3. Solid Carbide Tools are Employed for Rough-turning the Planetary-gear Carrier at Cutting Speeds up to 504 Surface Feet per Minute

Fig. 4. Diameter and Relative Positions of the Six Pinion-shaft Holes in the Planetary-gear Carrier are Maintained within Plus or Minus 0.0002 Inch in This Precision Boring Operation

tooth milling cutter, 4 inches in diameter by 2 inches wide, is rotated at 67 R.P.M. and fed to a depth of 7/16 inch, giving a chip load of 0.015 inch per tooth.

The work is held rigidly on an expanding mandrel mounted in the center of the rotary table, and is rotated at about 1 R.P.M. The cutter is automatically fed out to leave a 1-inch wide lug on the periphery of the ring.

After finish-boring and sand-blasting to roughen the surface of the bore, a band of special brake lining is cemented to it. The friction lining, 0.046 inch thick, is made from copper and lead powder and asbestos fiber. A firm bond between the resinous binder, the coated bore of the ring, and the liner is obtained by heating the assembly to a temperature of 350 degrees F. and subjecting it to a pressure of about 250 pounds per square inch (from an expanding fixture) for four minutes. The lining is then bored with diamond cutting tools and grooved with carbide tools, after which the assembly is split through the center of the lug.

The cast-iron flywheel housings are machined on a Newton double-spindle vertical milling machine, Fig. 6. The engine face of the housing

is rough- and finish-milled and the flywheel face is roughed in one set-up on this machine. The flywheel face of the housing is finish-milled in a subsequent operation at assembly.

The castings are clamped manually to fixtures on the rotary table of the machine, eight castings being held in the outer circle and four in the inner circle. The housings in the outer circle pass beneath the 15-inch diameter carbide-tipped roughing cutter, shown at the right, at the rate of 19 inches per minute. The castings pass under this cutter twice, their position being reversed between cuts so that both faces are roughed.

The rough-milled castings are then placed, flywheel face up, on the inner circle, where they pass beneath the 14-inch diameter finishing cutter at the rate of 10 inches per minute. Both the roughing and finishing cutters are rotated at 1800 R.P.M.

About 3/16 inch of stock is removed from each face of the housing in the roughing operation, and 1/16 inch in finishing. Care is required in clamping the parts, since too much pressure will cause the thin, complex sections to spring. Parallelism between the two faces of the housing is maintained within 0.0015 inch.

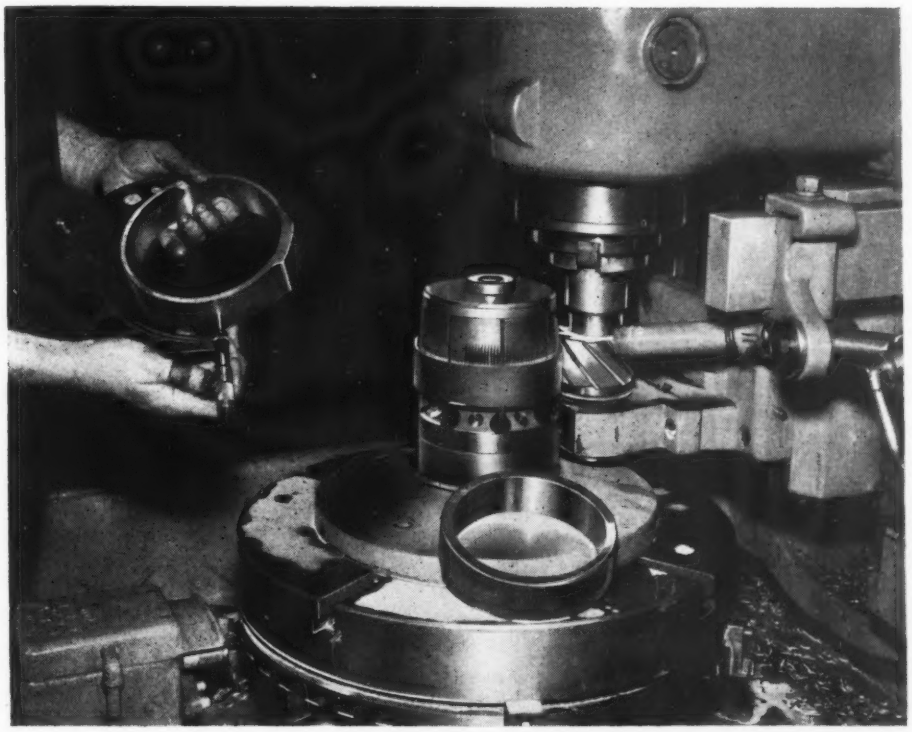


Fig. 5. Steel Plates, which are Rolled into Rings and Welded, are Milled in the Set-up Here Illustrated to Form Brake Bands

Fig. 6. The Faces of the Cast-iron Flywheel Housings are Rough- and Finish-milled on the Rotary-table, Double-spindle Machine Shown

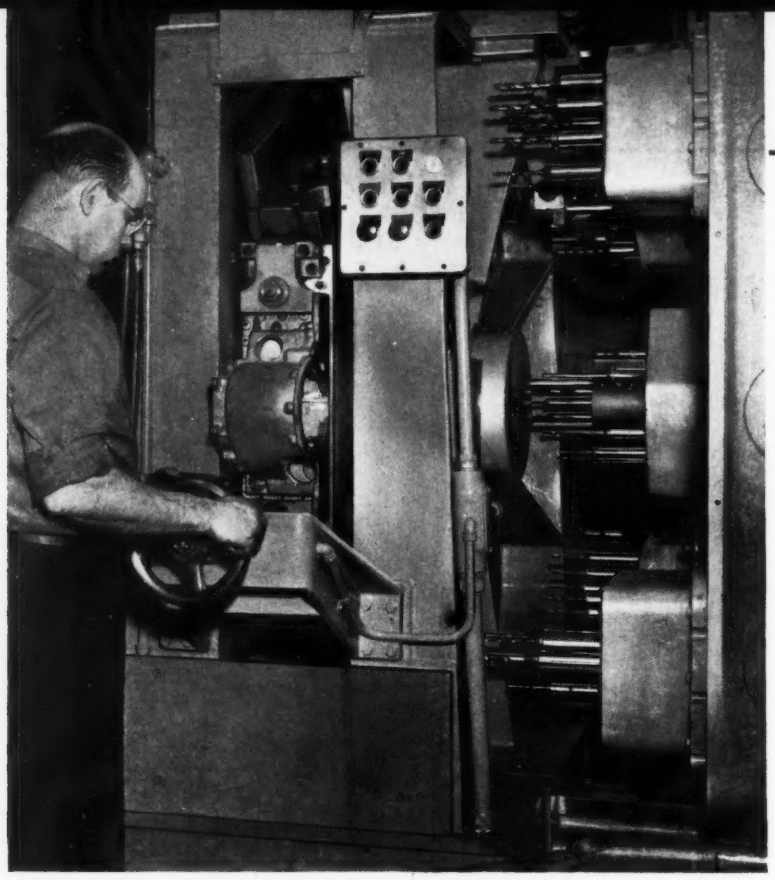


Fig. 7. Both Ends of the Transmission Case are Drilled at a High Rate of Production by the Use of a Two-way, Six-station Machine

All of the holes in both ends of the cast-iron transmission case are drilled on the Greenlee two-way, six-station machine seen in Fig. 7. Some of these holes are reamed and chamfered in the same set-up. The castings are clamped manually to the automatically indexing rotary fixture in the center of the machine. Brackets with integral bushings, mounted on this fixture, enter air spaces within the casting. The bushings serve to guide the drills when making interrupted cuts.

After drilling all the holes in the bottom face of the transmission case on a similar machine, fifty-eight holes, in both ends and in the bottom of the casting, are tapped in the special two-station Cross machine shown in Fig. 8. At the first station, all the tapped holes in the bottom face and some of the holes in one end of the

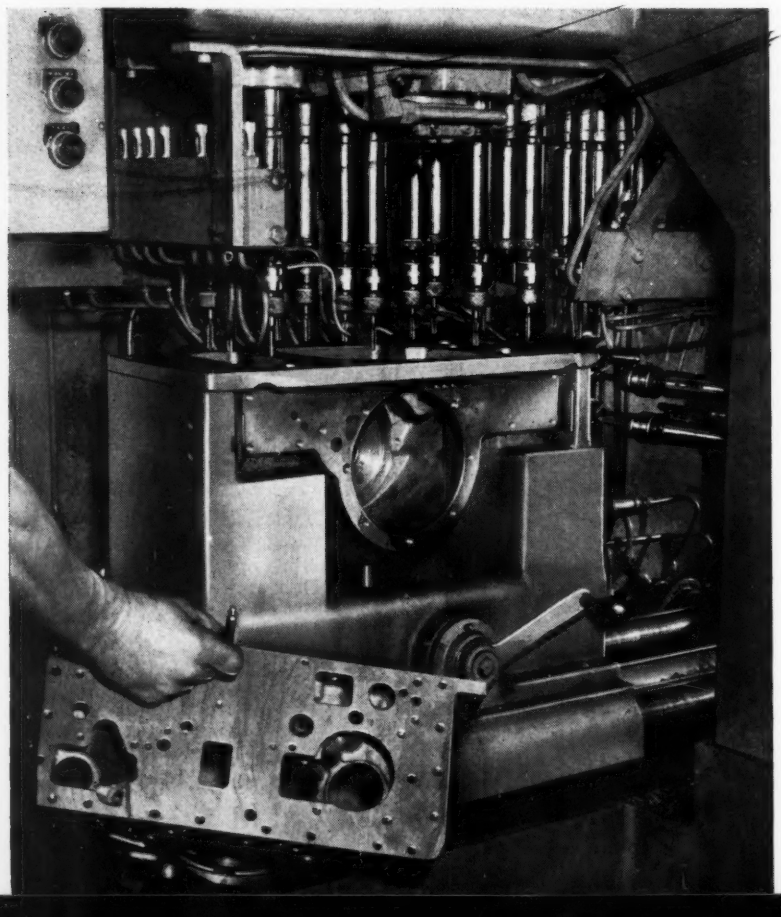


Fig. 8. Tapping a Total of Fifty-eight Holes in Both Ends and in the Bottom of the Casting on a Two-station Machine

Fig. 9. Nine Slots are Broached through the Thin-walled, Large-diameter End of the Reaction Gears in the Set-up Illustrated

casting are completed. The work is then automatically transferred to the second station, at the right, where the remaining holes are tapped.

For this operation, precision-ground Class 2 taps and full-floating tap-holders are mounted in the individual lead-screw spindles. A Farval lubricating system is employed to cool and clean the taps. With this system, a stream of coolant is directed on each tap as it is withdrawn from the hole. Coolant does not flow during the tapping operation. Good results are being obtained by using soluble oil instead of the mineral oil generally employed for tapping cast iron. The use of soluble oil eliminates the washing or degreasing required to remove mineral oil

The low-range reaction gears are forged from S A E 1050 steel bar stock. One of the final machining operations performed on these parts is the broaching of nine slots through the thin-walled, large-diameter end of the gear. This is accomplished on a Cincinnati 3-ton, 48-inch stroke vertical broaching machine, Fig. 9. Each slot is 0.384 inch wide by 1 1/4 inches long.

Since the wall of the gear at its large-diameter end is only about 1/8 inch thick, an internal expanding fixture is employed to obtain rigid support. Three broaches are mounted on the ram of the machine. It is therefore necessary to index each part three times. The ram is hydraulically fed at the rate of 38 feet per minute.

Both bore and face of the primary converter pump hub are finished on the Bryant grinding machine seen in Fig. 10. Since the work does not have to be reset between grinding operations, squareness of the face with the bore can be maintained within close tolerances. A facing wheel-head carrying a 4 1/2-inch diameter grinding wheel is mounted at the rear of the cross-slide on this conventional type bore grinder. About 0.010 inch of stock is removed from both bore and face of the S A E 5120 steel hub.

Clutch piston, "Servo" body, valve body, and reaction flange plate of the Dynaflow transmission are die-cast from A S T M 59 aluminum alloy, which contains from 10 to 12.5 per cent silicon. The iron content of this alloy is kept

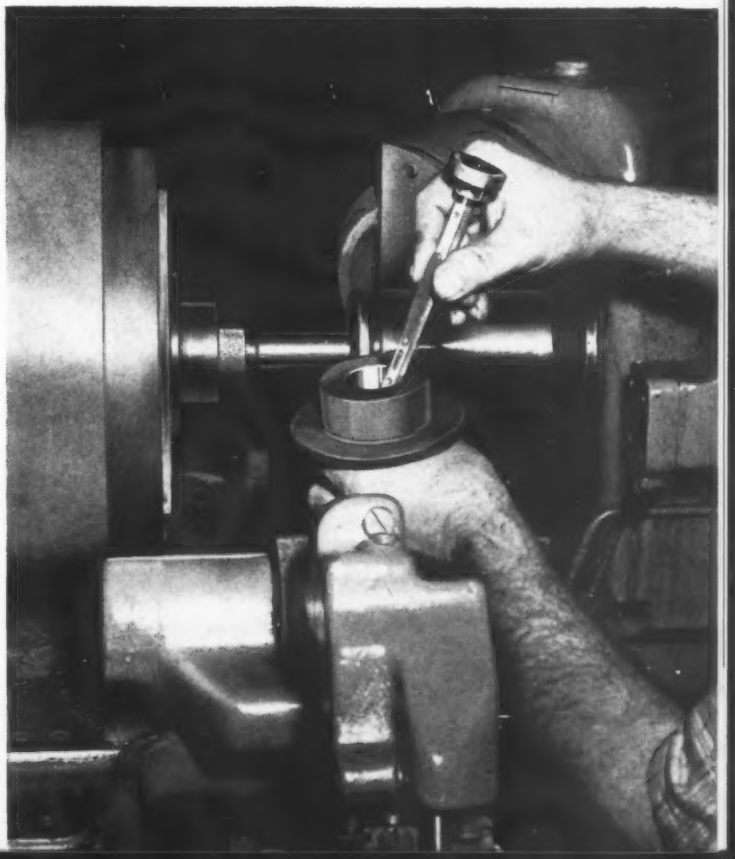


Fig. 10. Squareness is Maintained within Close Tolerances by Grinding Both Bore and Face of the Pump Hub in One Set-up

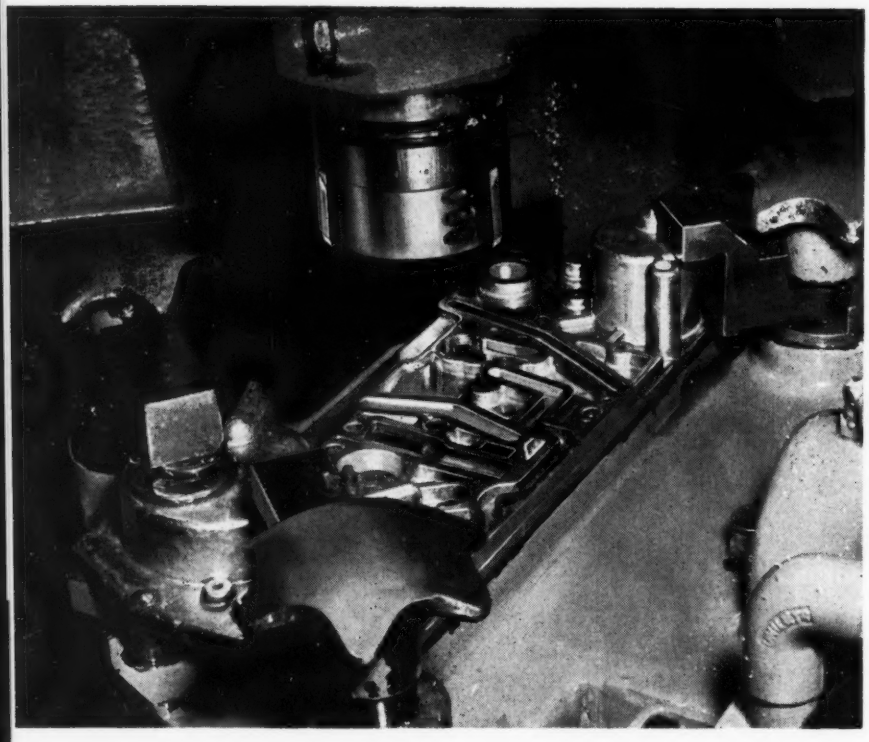


Fig. 11. The Flat Surfaces of the Die-cast Aluminum-alloy "Servo" Body are Profile-milled with the Set-up Shown

below 1.25 per cent, so that the parts can be machined readily. To insure dimensional stability, the die-castings are heated to 350 degrees F. for four hours, since parts of the transmission reach this temperature in operation.

The flat surfaces of the die-cast aluminum-alloy "Servo" body are profile-milled on an Ex-Cell-O machine, Fig. 11. The die-casting is clamped to the two cross-slides, mounted at 90 degrees with relation to each other. Movement of the work in various directions with relation to the cutter is controlled by electrical switches. The combination of movements of the two cross-slides gives the desired profile on the work. Three carbide-tipped blades are inserted in the 4-inch diameter end-mill, which is rotated at 3600 R.P.M. The depth of cut is 1/32 inch, and the work feed, 0.009 inch per revolution.

Following the profile-milling operation, the flat mating surfaces of the "Servo" and valve bodies are lapped to insure a good fit and prevent any leakage when the parts are assembled.

Recommended Speeds and Feeds for Milling Cast Iron with Carbide Tools

RECENT research by engineers of the Cincinnati Milling Machine Co., Cincinnati, Ohio, has shown that cutter life in the milling of cast iron depends on the microstructure of the material rather than on its hardness. It has been found that cast iron of similar hardness and composition may have entirely different tool-life characteristics.

For average grades of cast iron, with a Brinell hardness ranging from 150 to 220, the cutting speeds recommended for carbide tools are 350 to 250 feet per minute, depending on the uniformity of the material. For harder castings or for cast iron containing slag inclusions, the milling speed may have to be reduced to about 200 feet per minute to obtain satisfactory cutter life.

For all types of carbide cutters except thin saws, a feed per tooth of 0.008 to 0.020 inch is recommended; the high limit should be used when possible. For thin saws, the feed per tooth may run as low as 0.003 inch, depending upon the depth of cut and the proportions of the saw.

Let's Re-Establish a Sound Foundation for Industrial Progress

Under the heading "Reds Await U. S. Slump" a recent Washington news dispatch quoted a Congressional Committee report that the Communists are counting on a severe depression in this country soon and timing their world revolution drive to coincide. If extra inducement were needed to persuade us to take immediate and vigorous steps to prevent a slump, here it is.

What is to be done? Reduced to the simplest terms, the job is to maintain our high level of production and demand, stepping up the volume of things in short supply and reducing production costs so that the greater supply could be offered at a lower price. Such an achievement would operate as a double check on inflation and, unlike other inflation-checking measures being advocated, would involve no risk of starting a dangerous backfire.

The heart of this problem, admittedly a complicated one, is how to increase our *productive efficiency.* Sustained high-level demand is an obvious essential if production and employment are to be maintained at high levels, and if it is true that high prices are building up consumer resistance, the answer to that is lower production costs which will make lower prices possible. That ties back directly to the need for productive efficiency.

With many things still in short supply, there is need for increased production in some lines, and as skilled labor continues to be scarce, the answer again is increased productive efficiency. Ability to support a rising wage scale, desirable in itself and as a contributing factor in the maintenance of active demand, again ties directly back to increased productive efficiency. For generations prior to the war, steadily rising living standards were made possible by a steady increase in productive efficiency. The importance of restoring this essential to industrial progress must be obvious to all.

Here is an undertaking in which the interests of labor, capital, and the consuming public are directly and equally concerned, and from which all will benefit. It is a common cause that should enlist vigorous and unstinted cooperation on the part of leaders in labor, industry, and national affairs. We strongly commend the following report of a committee appointed by the National Conference of Business Paper Editors, which analyzes this important question and puts forward definite recommendations for action.

President of The Industrial Press, Publishers of MACHINERY.

THE COMMITTEE REPORT

It is highly important that industry find ways and means of increasing individual productive efficiency and this should be done quickly and on the broadest possible scale. Increased individual productivity can be accomplished by (1) improved equipment and production technique; (2) effective management-worker cooperation, so that available equipment and techniques are utilized to the maximum; and (3) on-the-job worker training programs to increase individual skills.

Professor Sumner H. Slichter, of Harvard, has recently made the well founded assertion that "the plant of industry is too small for the present labor force and much of it is obsolete." He goes on to point out that during the last eighteen years there has been very little net capital formation in American industry. Throughout most of this period, plant and equipment have been wearing out or becoming obsolete at a faster rate than they have been replaced. Not all of this equipment has been scrapped; much of it has been kept as "stand-by." In the meantime, 9,000,000 more workers were employed in private industry in 1947 than in 1929, and, in the nature of things, many of these workers are having to do their producing with "stand-by" or second-best equipment. With such a handicap, it is no wonder that the average rate of production is practically stationary—even without the added burden of "featherbedding" and other union restrictions on output.

Professor Slichter further points out that American industry has, today, one-fifth less capital per worker than it had in 1929; that an expenditure of $50,000,000,000 would be needed on plant and equipment in order to bring the capital per worker up to the 1929 level; and that a proportionately larger outlay above that $50,000,000,000 would be required to restore capital per worker to the basis of the 2 per cent annual increase which is "normal," as judged by many years of experience before the great depression.

Under a regime of private enterprise, the volume of capital outlay by industry depends upon the pro-

spective profitability of such expenditure. It is doubtful whether most members of labor organizations realize the importance to them—in their own selfish interests—that industry be permitted the profits that will encourage it to invest increasing funds to provide the average worker with a supply of tools which is constantly increasing in quantity and quality.

In the dangerous world of today, America is "on the spot" to increase its productive capacity to equal the demands of any emergency. With the American people themselves, America's traditional regime of private enterprise is also "on the spot" to provide the constant increase in the general standard of living which comes only by increasing the average productivity of those employed. This increase in productivity, which is so urgently needed in the interest of everybody, requires not just the abandonment of all "featherbed" limitations on output, by whomever imposed, but, as well, the restoration of conditions which will greatly increase outlays on plant and equipment.

Much or all of Britain's present economic difficulties are ascribable to low output per worker, occasioned by inadequate capital investment in modern equipment and plant—and startling contrasts are shown between productivity per worker in kindred employment in Britain and America, these differences being wholly ascribable to the relative supply of capital per worker provided in the two countries. Surely America does not wish to risk such troubles as Britain is enduring, by permitting the principal cause of Britain's plight—inadequate investment in improved plant—to become an established malady on this side of the Atlantic. Business leadership has a social responsibility to explain these things to its employes and the public generally.

Assuming that industry undertakes a vigorous program of re-equipment to modernize existing production facilities, the next step is to obtain the active cooperation of the workers themselves. It is obviously useless to install modern equipment in a shop if that equipment is not going to be used in a way that will increase productive efficiency. Whatever the attitude of the rank and file in industry—and it has been authoritatively stated that the majority of workers favor incentive systems—the fact remains that most union labor leaders are opposed to measures that would induce the individual worker to produce more, and have, with a few exceptions, succeeded in blocking efforts in that direction. This subject is perhaps not politically popular, but until it is faced squarely, American industry will find it as hard to increase productive efficiency as the driver of an automobile would find it hard to accelerate his car rapidly with the emergency brake set.

Hostility toward incentive plans and other measures calculated to increase productive efficiency arises from a combination of ignorance and suspicion, for both of which industry is partly, if not chiefly, to blame. As long as workers fail to see how they can benefit from increased efficiency on their part and suspect that it may even lead to losing their jobs, it is quite natural that they will have no enthusiasm for programs of this kind. It is up to management to remove any reason for the validity of such criticism, and, having done so, it will have every right to ask for and receive cooperation from intelligent labor leaders who are sincerely interested in the welfare of their members.

Granted that the task of removing ignorance and suspicion is a complicated and difficult one, proof that it can be done exists in a considerable number of plants throughout the country. Once labor has been shown and convinced that higher money wages are meaningless unless accompanied by increased productive efficiency, and conversely, that a higher level of productive efficiency is the essential basis for higher real wages, a solid foundation of common interest is established for management and labor. Once this goal has been made a joint one by both management and labor, great strides can be made. Without such cooperation, it will quickly bog down.

The job, then, is a two-way matter—for management to devise a program and to give such assurances as will encourage the cooperation and support of enlightened labor leaders. If only a few outstanding leaders in industry and labor would get together, formulate a plan, announce their intention to march together in a common cause, general progress toward the goal should come quickly.

The first essential step is that a group of top labor and industrial leaders come together to work on this project. If they will do so, the following program might be an effective one for them to pursue:

1. Agree that their immediate and major objective is increasing individual productive efficiency in industry.

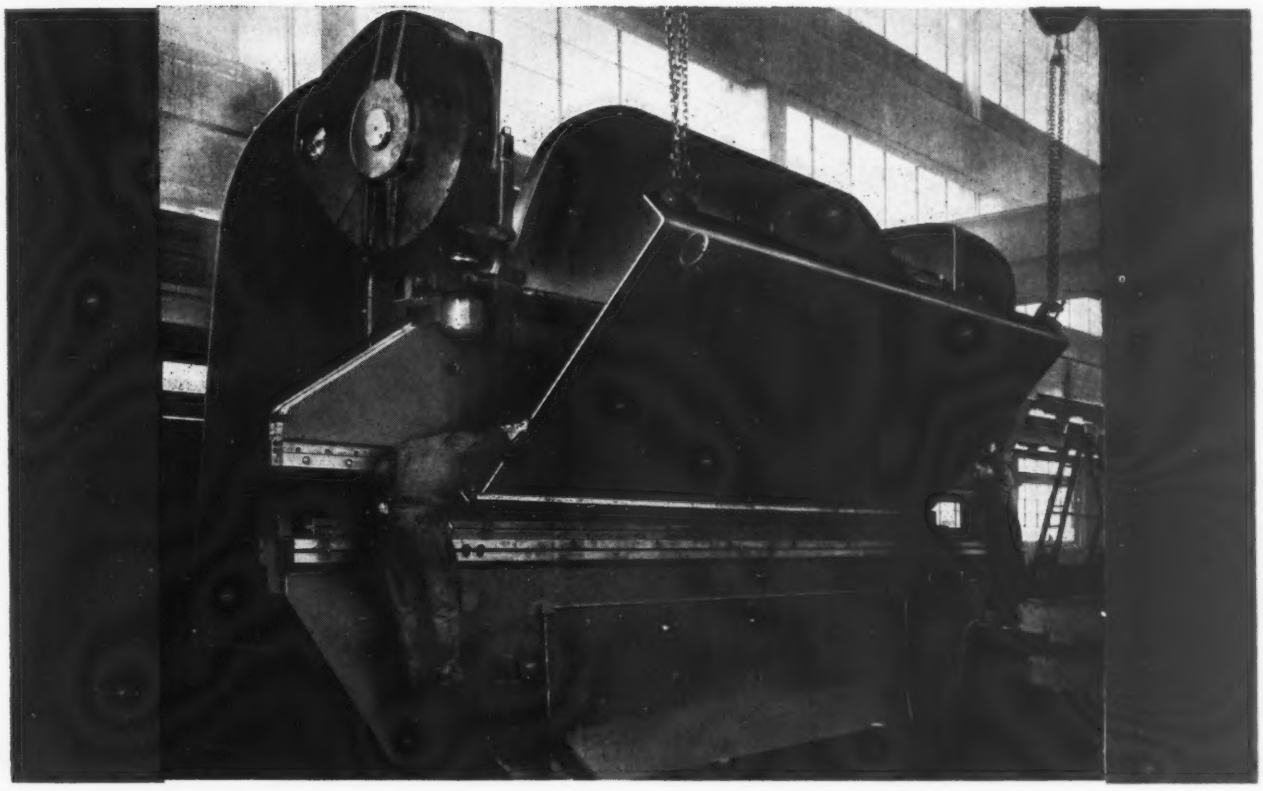
2. Conduct an educational campaign through the whole country to show that labor is hurt, not benefited, by lower productive efficiency and "featherbedding" practices.

3. Give maximum publicity to the recognition that this objective has a direct and important bearing on national welfare, as well as that of both industry and labor.

4. Stress the fact that management and workers have a common stake in the accomplishment of this aim; and that these leaders of labor and industry have undertaken to work together with the utmost vigor to attain this goal.

5. Make objective studies of all phases of the problems and make the findings known, pointing to instances where these ideas had already been successfully applied; listing methods and practices which experience shows give satisfactory results; and inviting everyone in industry and unions to join them in this endeavor.

Versatile Applications of the Press Brake



Concluding Installment of an Article on Applications of Press Brakes. Materials that Can be Formed, Tolerances Maintained, and Operations on Press Brakes are Discussed

By W. EARL PETERS, Chief Die Engineer
Cincinnati Shaper Co., Cincinnati, Ohio

IN addition to the numerous types of hand brakes generally used in the sheet-metal industries, many sizes of power-operated press brakes are now available for forming the thicker plates. Most press brakes operate between 5 to 50 strokes per minute. Production rates, however, usually are determined by the handling time. Small, easily handled parts have been formed at production rates as high as 600 per hour.

One of the largest two-housing mechanical brakes ever built is shown in the heading illustration. This huge press brake weighs about 125 tons, measures over 20 feet between housings, and has a die surface 30 feet long. The press is shown making a right-angle bend in one stroke on a steel plate, 3/4 inch thick by 20 feet long, under a pressure of 1000 tons Larger machines have been made by placing several press brakes side by side and interlocking their controls. Because of the open-end construction of a press brake, work longer than the ram can

Fig. 1. Removable Angle Brackets are Provided on the Ram and Bed of This Press Brake to Give the Wide Die Surface Required for the Job Shown

sometimes be moved through the press in progressive stages. The operations should be performed directly under the ram, whenever this is possible.

A fundamental design feature of the press brake is a narrow ram nose, which permits the forming of sharp angles in sheets and plates. However, by adding removable angle brackets, as shown in Fig. 1, a press brake can be converted into a wide-bed press without interfering with its subsequent use for bending. In this way, the width of the bed can be increased to 42 inches or more.

Many attachments are available to increase the flexibility of the press brake. A taper ram adjustment permits tilting the ram as much as 1/4 inch per foot of ram length for "fade-out" work, such as ventilating ducts. The ram need not be tilted for forming conical work, since such shapes can be produced by drawing lay-out lines between equal divisions at each end of the sheet.

A combination of manual control and electric control is advantageous for versatile operation. Manual control is desirable for certain operations that require slipping of the clutch. Electrically controlled, air-operated clutches can be arranged for "inching" or jogging, and such electric control usually includes provision for automatically stopping the ram at the top of its stroke.

A tonnage indicator, which shows the load on the press ram directly in tons, is a decided advantage for keeping the brake within its capacity. Such indicators can be divided into sections showing the V-die bending capacity and the higher pressures that can safely be used for intermittent work near the bottom of the ram stroke.

Filler blocks, or die-holders, are available in several types and sizes suitable for various kinds of forming. Beds and rams can be extended at one end for closing or "horning" operations, as illustrated in Fig. 2. Also, both ends of the bed and the ram can be extended to increase the over-all surface of the die.

Fig. 2. Both Bed and Ram of This Press Brake have been Extended in Length to Permit Closing of the Square Sheet-metal Form Shown

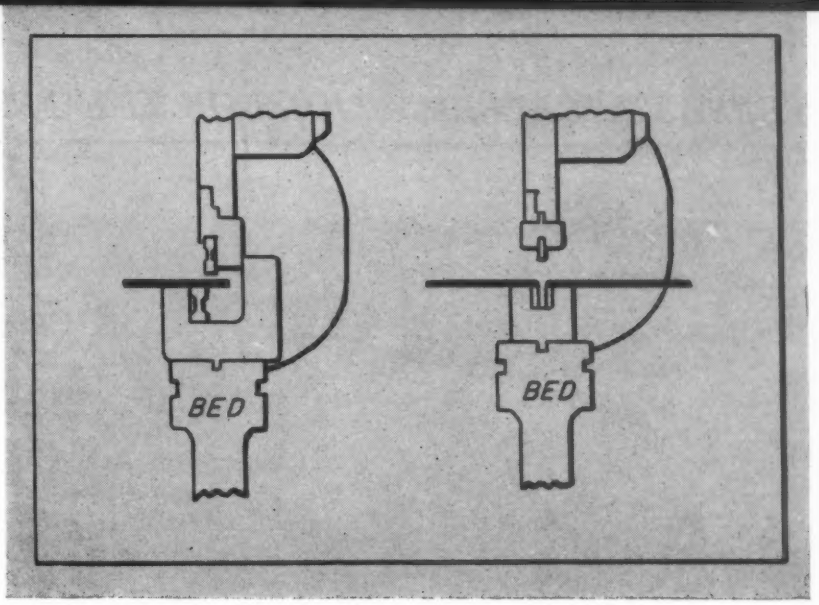


Fig. 3. Press-brake Trimming Attachment at Left is Limited to Operations Near the Edge of the Sheet. With the Parting Die at the Right, Sheets of Any Width Can be Sheared

Special speeds, variable speeds, or multiple speeds can be provided for press brakes. A two-speed transmission gives a slow speed, with full flywheel energy, for special work, in addition to the normal speed for regular production. Variable-speed drives should be limited, when practicable, to light work on small press brakes, since the flywheel energy is reduced as the speed decreases. For example, if the flywheel speed is reduced by one-half, the energy is diminished to about one-fourth.

Attachments are available for performing shearing operations on press brakes, but they are not recommended for accurate work. Adequate lateral (front to back) rigidity is necessary to maintain proper blade clearance and prevent the formation of burrs. Also, the methods of holding down the sheet to be sheared are either cumbersome or inefficient.

Two shearing attachments are shown in Fig. 3. In the attachment shown at the left, the back of the open die is used to take the horizontal thrust of the shearing operation. This limits the attachment to trimming operations near the edge of the sheet. With the parting attachment, shown at the right, the plate must overhang both knife blades in the open die on the bed of the brake. While a narrow strip of stock is wasted with this arrangement, the width of sheet that can be cut is unlimited.

Universal gages with micrometer adjustment can be used on either the front or rear of the press. As shown in Fig. 4, horizontal gage-rod *A* can be moved to the approximate locating position and clamped with cap-screw *B*. Accurate location is then accomplished with micrometer nut *C* and lock-nut *D*. The bent end of gage-rod *A* can be placed either up or down, or the rod can be replaced with a straight piece of round stock that is notched to make an adjustable two-step gage.

Most press brakes have the bed and ram designed to be parallel when normal loads are distributed evenly over the working length. This is accomplished by crowning the bed and ram. Noticeable deflection will result from a distributed load that is greater than the rated capacity or from a highly concentrated load somewhat less than the rated capacity. Such deflection can usually be corrected by placing shims under the dies. Harder hitting by the use of greater pressure is seldom effective for this purpose.

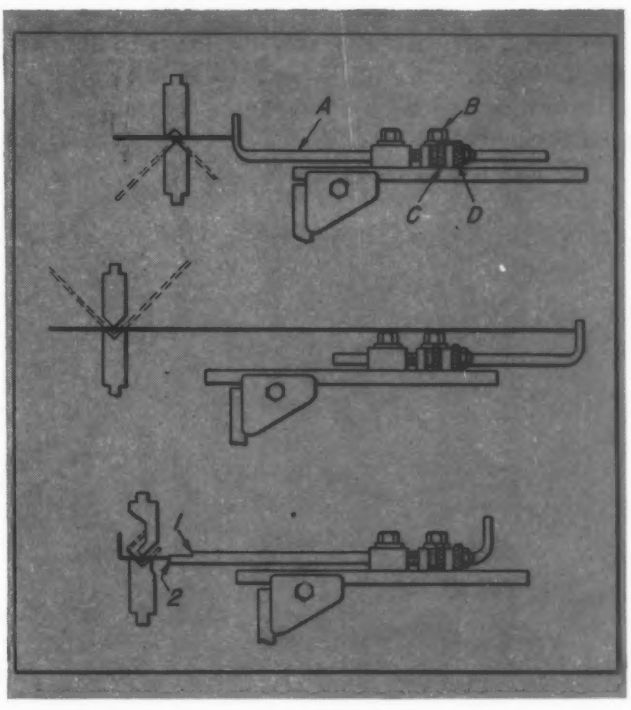


Fig. 4. Various Settings Can be Made on a Press Brake by Adjusting Universal Gages, which May be Mounted at Front or Rear

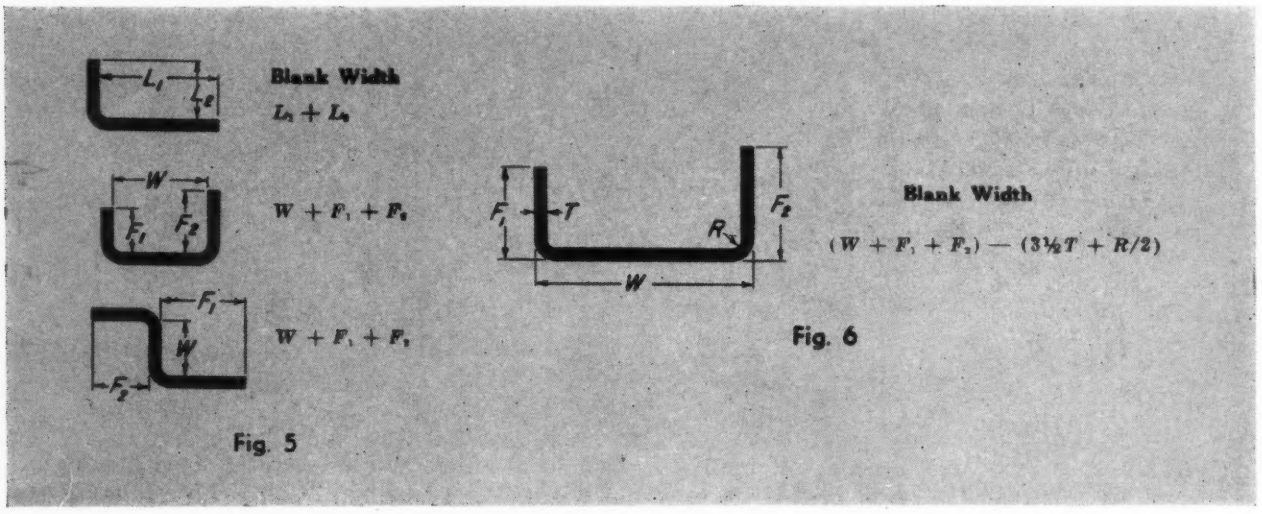


Fig. 5. Method of Calculating Blank Width for Forming the Shapes Shown when the Inside Radii of the Work are Equal to the Thickness of the Metal
Fig. 6. Method of Calculating Blank Width when the Inside Radii of the Part being Formed are Not Equal to the Metal Thickness

Materials that Can be Formed on Press Brakes

Steel in the cold-rolled form is well suited for press-brake operations. Hot-rolled steel can be worked satisfactorily, but it should be pickled before forming to prevent excessive wear of the dies. Aluminum, brass, bronze, copper, magnesium, stainless steel, Monel metal, and zinc alloys are other metals frequently formed on press brakes. Occasionally, such machines are also used on non-metallic materials such as wood, rubber, cardboard, etc. One unusual application for which a press brake was employed consisted of breaking thick slabs of limestone.

Blanks are sometimes masked with oil-impregnated paper or sprayed with plastic to protect the finish while forming. These coatings can be easily peeled from the formed part. Lubrication is required only for severe drawing operations. In such cases, a high quality drawing compound can be employed with good results. Lubrication of unpickled steel, however, is of little benefit.

Tolerances Maintained on Press-Brake Work

Over-all tolerances on press-brake work are usually greater than those specified for stamping or roll forming. For relatively long, but narrow, simple shapes, a tolerance of plus or minus 1/32 inch can generally be maintained.

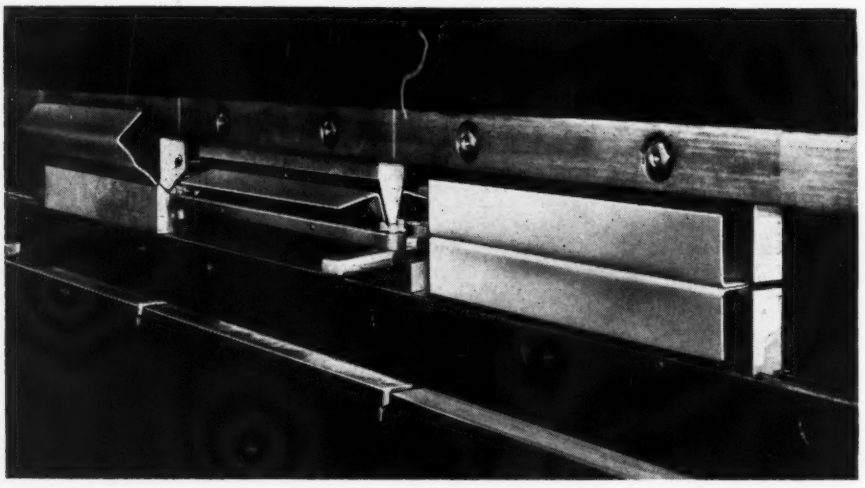


Fig. 7. Progressive Forming is Often Performed on a Press Brake by Mounting the Dies Side by Side

Pressures Required to Punch Mild Steel

Thickness of Metal		Hole Diameter, Inch														
Gage	Inch	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1
		Pressure, Tons														
20	0.036	0.35	0.53	0.71	0.88	1.1	1.2	1.4	1.6	1.8	1.9	2.1	2.3	2.5	2.7	2.8
18	0.048	0.47	0.71	0.94	1.20	1.4	1.7	1.9	2.1	2.4	2.6	2.8	3.1	3.3	3.5	3.8
16	0.060	0.59	0.89	1.20	1.50	1.8	2.1	2.4	2.7	2.9	3.2	3.5	3.8	4.1	4.4	4.7
14	0.075	0.74	1.10	1.50	1.90	2.2	2.6	2.9	3.3	3.7	4.1	4.4	4.8	5.2	5.5	5.9
12	0.105	1.00	1.60	2.10	2.60	3.1	3.6	4.1	4.7	5.2	5.7	6.2	6.7	7.2	7.7	8.3
11	0.120	1.20	1.80	2.40	3.00	3.5	4.1	4.7	5.3	5.9	6.5	7.1	7.7	8.3	8.8	9.4
10	0.135	....	2.00	2.70	3.30	4.0	4.6	5.3	6.0	6.6	7.3	8.0	8.6	9.3	10.0	10.6
3/16	0.187	....	2.80	3.70	4.60	5.5	6.5	7.4	8.3	9.2	10.2	11.1	12.0	12.9	13.8	14.8
1/4	0.250	....	....	4.90	6.20	7.4	8.6	9.8	11.0	12.3	13.5	14.8	16.0	17.2	18.5	19.7
3/8	0.375	....	....	....	....	11.1	13.0	14.8	16.6	18.5	20.3	22.1	24.0	25.8	27.7	29.5
1/2	0.500	....	....	....	....	....	17.2	19.7	22.1	24.6	27.1	29.5	32.0	34.4	36.9	39.4
5/8	0.625	....	....	....	....	....	....	....	....	30.8	33.8	36.9	40.0	43.0	46.1	49.2
3/4	0.750	....	....	....	....	....	....	....	....	....	....	44.3	48.0	51.7	55.4	59.0

Larger parts of more complex cross-section may require tolerances as great as plus or minus 1/16 inch.

Portions of the work formed in the die, however, can be held to about plus or minus 0.015 inch. Total tolerance on hole diameters and spacing for punched work is generally about 0.010 inch. Parts are seldom formed in multiple by stacking blanks on the die, because of the inaccuracies resulting from this method. Certain thin parts, where accuracy is of little importance, are made in this way.

Determining the Size of the Blank

Many methods have been worked out for determining the amount of metal required for forming shapes having 90-degree bends. Most of these methods, however, are empirical, as the actual amount of metal required varies with the uniformity of thickness, hardness, and direction of grain of the material, as well as with the speed of the forming operation. To obtain accurate results, the blank size should be determined by actual trial.

For most press-brake work, where the inside radii R on the work approximately equal the thickness of the metal T, the developed widths of the shapes shown in Fig. 5 can be calculated from the formulas given in that illustration. As these are inside dimensions, the bend lines should, of course, be marked on the inside of the blank.

Where the inside radii are not equal to the metal thickness, the formula shown in Fig. 6 and the outside dimensions of the work are used to determine the blank width. To apply this formula to a multiple-bend part, add all outside

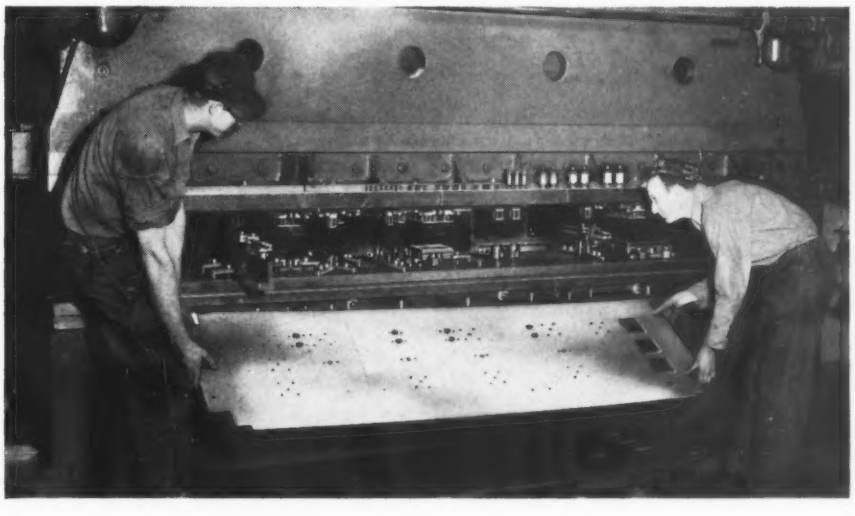


Fig. 8. Adjustable Dies can be Mounted on Removable Angle Brackets to Perforate Wide Sheets as Shown

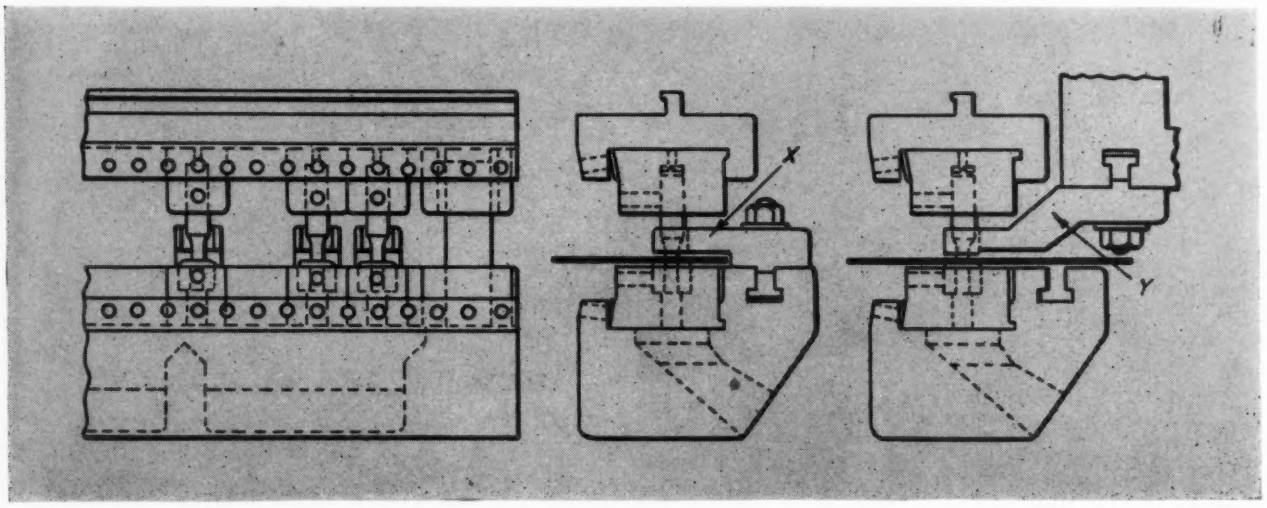


Fig. 9. Method of Holding Punch- and Die-blocks on Adjustable Centers in a Press Brake. Different Designs of Strippers are Shown at X and Y

dimensions around the work, and then subtract the quantity $(3\ 1/2\ T + \frac{R}{2})$ for each *two* bends on the part.

When the radii are more than three times the thickness of the metal, the width of the blank should be calculated on the neutral plane (center) of the metal, as little stretching occurs.

Performing Progressive Forming and Notching Operations

On stock that is sufficiently short to permit it, progressive forming or notching, or both, is often employed to speed production. As many as twelve separate operations have been performed on one press brake by placing the dies side by side along the press bed and ram. Work requiring several machines and much handling or separate set-ups on the same brake can be produced in this way.

Such an arragement can be handled by one operator, who carries the work from station to station. To speed up production, more than one operator can be employed, the work being passed from one operator to another, and a part being completed with each stroke of the ram. Marring of the work due to handling is minimized, initial machine investment is lowered, and floor space is conserved. Fig. 7 shows a typical progressive forming set-up in which four operations are performed by the use of three dies, mounted on a single press brake.

Fig. 10. Forming the Rims for Large Steel Gears on Press Brakes. Gear Teeth are Subsequently Cut in the Completed Ring

Punching Operations on Press Brakes

Pressures required to punch holes of various diameters in different thicknesses of mild steel plate having a shearing strength of 50,000 pounds per square inch are given in the accompanying table. These pressures, in tons, were determined by multiplying the diameter of the hole by the thickness of the metal (both in inches) and multiplying the result by 78.75.

If the hole to be punched is not circular, use one-third of the perimeter of the shape to be punched for the diameter in the tonnage calculation. The tonnage required for punching other materials is directly proportional to their shearing strength.

To obtain the total pressure required for "one-level" multiple punching, where all the punches are located at the same distance from the die and the work, simply multiply the pressure shown in the chart by the number of holes to be punched. If the punches are "stepped" in relation to each other by a distance equal to one-half of the metal thickness or more, the total pressure required will be reduced by one-half for punches on two levels, one-third for punches on three levels, and one-fourth for punches on four levels. The total tonnage employed in punching should not exceed approximately two-thirds of the rated capacity of the brake. This will insure smooth operation and will prevent undue stresses from being imposed on the machine.

For best results in punching mild steel on press brakes, the diameter of the die should be from 10 to 14 per cent of the metal thickness larger than the punch. For hard or stainless steels, the die need only be from 6 to 8 per cent larger. Spacing between holes or from a hole to the edge of the sheet should be about 1/2 inch or more, and never less than the thickness of the metal being punched.

Several points in design that facilitate punching operations are illustrated in Fig. 9 The upper and lower bolsters of the press brake can be provided with set-screws for holding the punch and die-blocks on adjustable centers, as shown. With a stripper of the type illustrated at *X*, which is supported on the bed of the press, holes can only be punched to within about 2 inches of the edges of the sheet. However, with a stripper such as shown at *Y*, which is supported from the press-brake housings, the work can be so positioned as to punch holes anywhere on the sheet. For stripping thin materials, 12-gage or thinner, cylindrical rubber collars can be slipped over the punches.

Adjustable die sets, mounted on removable angle brackets bolted to the press-brake bed and ram, are sometimes employed to perforate large sheets. A job of this kind is illustrated in Fig. 9 being performed with die sets made by S. B. Whistler & Sons, Inc. Provision for "gagging" can be incorporated in these dies to make the punches not needed inactive, and thus increase the flexibility of the dies. Clamping of the work is sometimes required for heavy punching operations.

Special Applications of Press Brakes

A rather special application of the press brake is in the forming of thick rims for large steel

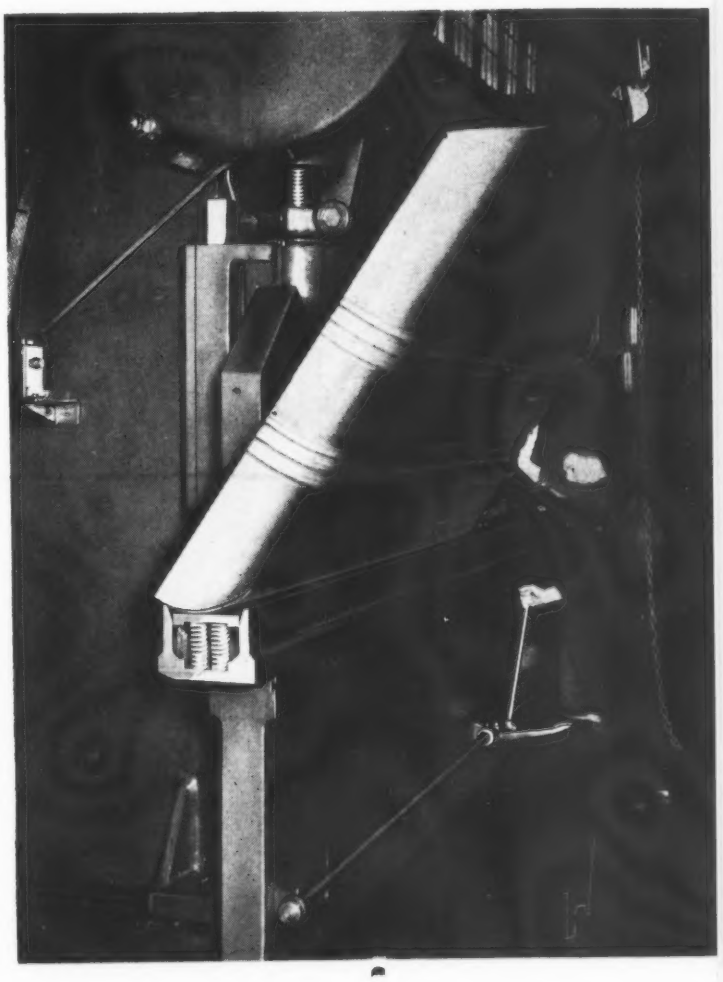


Fig. 11. Spring-operated Pressure Pads Hold This 1/8-inch Thick Plate against Upper Die while it is being Formed into a Truck Body Side

gears. When the ram descends, the tapered face on the upper die, Fig. 10, forces a wedge block that is gibbed to the bed of the brake to the left. This bends the metal bar between a pair of curved-face dies. The bar is then advanced for curving another section. When the ring is completed, the ends are welded together, and teeth are cut in the periphery.

A truck body side made from 0.50 per cent carbon steel, 1/8 inch thick, is shown being formed to a 6-inch radius in Fig. 11. A spring-operated pressure pad holds the plate against the upper die to insure a smooth bend. Corrugations were made in the part in a previous operation on another press brake.

Other uses of the press brake include the embossing of railroad crossing and road signs, numbering of automobile license plates, and crimping of sheet and plate before rolling to eliminate flats at the seam edges of the rolled shapes.

Although the press brake is still not a familiar machine in some sheet-metal and plate shops, the applications described in the foregoing indicate that it has almost universal application where sheet metal and plate are used.

Precautions to Observe in Operating Press Brakes

1. Always change or adjust dies with the ram just past the bottom of its stroke. In this position, the ram can only move up if the clutch is accidentally engaged.

2. When the press brake is left idle, make a note of the ram setting. Check this setting before starting the operation again, as someone may have changed the adjustment.

3. Operate the press brake within its rated capacity. Use a tonnage indicator wherever possible.

4. Use a motorized ram adjustment for making adjustments only—not for bending.

5. Avoid bringing short-length dies together under high pressures; they might be forced into the ram or bed.

6. Keep the dies clean and the machine in good condition. Keep punching and blanking dies sharp.

7. Perform short work near the center of the press brake whenever possible, to equalize the pressure on both housings.

8. Use only first-quality sheets or plates. Pickle hot-rolled stock before forming whenever practicable.

9. Use a balanced die, with the loading equally divided about the center line of the ram.

Metal-Working Equipment Should be Included in the Marshall Plan

TO help the politically free nations of Europe help themselves is the aim of the European Recovery Program. Food, clothing, and other absolute necessities will be provided in vast quantities, but what is even more important, the nations will also be supplied with great amounts of agricultural equipment, mining machinery, railway rolling stock, textile machines, and so on, in an effort to aid them regain a sustaining economy.

Transportation requirements of the nations that will participate in the program include over 700,000 freight cars, besides thousands of locomotives and passenger cars. Coal-mining equipment to a value of three and one-half billion dollars and oil-refining equipment costing close to two billion dollars are needed.

A generous proportion of all this equipment will be provided by the United States, and it is expected that the remainder will be produced by the various participating countries. Because of this objective, it is rather astonishing that the Marshall Plan does not contain any provision for shipping machine tools, welding equipment, or other metal-working machinery abroad. Only by the use of modern metal-working equipment can the nations help themselves in time to avoid a worsening of their economic and political plight.

With modern machine tools in European shops, the production of railway cars, weaving looms, mining machinery, etc., could be expedited abroad. The United States would need to send less fully completed equipment overseas, and the various countries would give more employment to their own citizens.

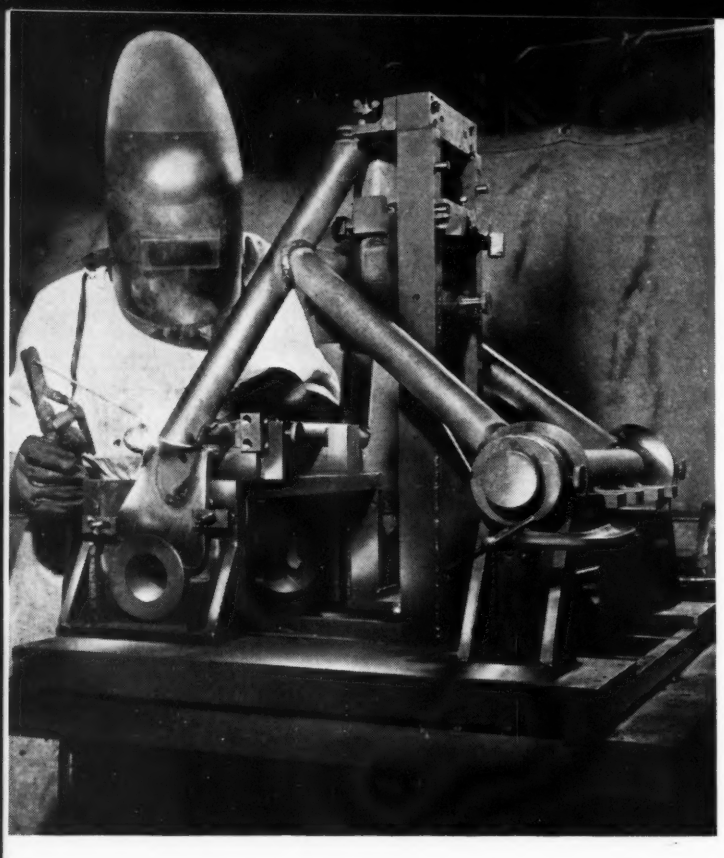
As Alexander G. Bryant, president of the National Machine Tool Builders' Association, cogently pointed out recently to the Committee on Foreign Affairs of the House of Representatives: "With machine tools, and only with machine tools, can Europe produce end products made of metal or repair the equipment in their devastated railroad shops and factories. Machine tools are not only the basic machines of industry, but in their unique ability to reproduce themselves and repair other equipment, they constitute the seed of industrial operations."

Well authenticated advices from industries abroad indicate that the European nations are desperately in need of modern metal-working machinery. In France, for example, importers of American machine tools have actual orders on hand for several million dollars worth, which would be placed at once if dollar exchange were available.

If the war-devastated countries are really to help themselves, the final draft of the Marshall Plan should provide authority for the administrator to negotiate for the purchase of machine tools and other metal-working equipment by the participating European countries. Fortunately, some of the most influential men in Congress now seem to favor some such provision.

Charles O. Herb

EDITOR



Welding a

ALTHOUGH the assembly of structural sections by arc-welding is usually considered applicable only to products having large dimensional tolerances, the Sperry Gyroscope Co., in its plant at Great Neck, L. I., recently proved the practicability of such a procedure in the manufacture of precision antenna pedestals for ship fire control mechanisms. The over-all tolerances on the completed structure, which is approximately 20 inches square by 25 inches high, are ± 0.005 inch on most dimensions, and the maximum allowable variation on all other dimensions is ± 1/64 inch.

The pedestal, shown in the heading illustration, consists of one piece of 1 1/4-inch and seven pieces of 2 1/2-inch cold-drawn seamless steel tubing, several cold-rolled steel flanges and trunnion plates, and an intricate bronze casting that must be welded to the side of one of the steel tubes. Specifications require that these pieces be joined into a water-tight structure without distortion, since any deflection in the frame would be reflected many times over in the gun-sight mechanism, thus destroying the accuracy of the instrument.

The success of the fabrication of this pedestal can be attributed to (1) precision machining of each section prior to assembly; (2) arc-welding of all sections in special welding fixtures of the type shown in the heading illustration; and (3) finish-machining of the critical sections of the pedestal.

The first operation on this piece consists of end-milling the profiles on each tubular section. This is done in special fixtures that locate the piece for length and angularity, so that the profile on one end is the correct distance from that on the other end, and in the correct angular position with respect to it.

After machining, the circular flanges and flat mounting plates are placed in a fixture and tack-

Fig. 1. Checking a Welded Pedestal for Dimensional Accuracy. Most Dimensions Must be Held within Plus or Minus 0.005 Inch

Highly Accurate Tubular Structure

welded to the tubular section that forms the pedestal base. This sub-assembly is then arc-welded and mounted in the main assembly fixture, where the remaining pieces are tack-welded together. The main assembly fixture is made of heavy cold-rolled steel plates, and is equipped with clamps that hold the parts rigidly to prevent any distortion due to irregular heating.

The operation that caused the most difficulty and subjected the assembly to distortion was the welding of the bronze casting to the tubular steel leg. Originally, the bronze casting and the steel tube to which it was to be joined were preheated to equalize the difference in the melting point of the bronze and steel. Then an attempt was made to fuse the casting to the pedestal. This procedure not only caused distortion but did not result in a satisfactory joint between the two metals. Now the casting is arc-welded to the tube with "Aerisweld" electrodes, manufactured by the Lincoln Electric Co., Cleveland, Ohio. The use of these bronze electrodes eliminated the problem of distortion and provided watertight fusion of all joints.

Following welding, the assembly is checked for dimensional accuracy, as shown in Fig. 1, and some of the welds are inspected by X-ray. The pedestal is then heated at a temperature of 950 to 1000 degrees F. for two hours and cooled in the oven; this is done in order to relieve any stresses that may have been set up in previous operations.

Finally, the frame is machined on a Giddings & Lewis horizontal boring, drilling, and milling machine, as shown in Fig. 2, to secure accurate and flat mounting surfaces and to correct any inaccuracies that may exist. The fixture used in this operation can be clamped on a turntable on the boring machine in either a horizontal or vertical position, and consequently is the only fixture required for the complete machining job. After machining the four end plates on the base of the pedestal, the operator rotates the turntable and fixture 90 degrees to machine the flanges, and then positions it to drill and countersink three 21/32-inch holes in the trunnion plates and to drill and tap two holes in the bronze casting. Other drilling operations are performed on standard vertical drilling machines.

This method of manufacture has resulted in a considerable saving in labor and a minimum amount of work handling, with no sacrifice in the quality of the product.

* * *

Henry Ford made 871 experimental tractor models and spent $7,000,000 before he was willing to put his first tractor on the market.

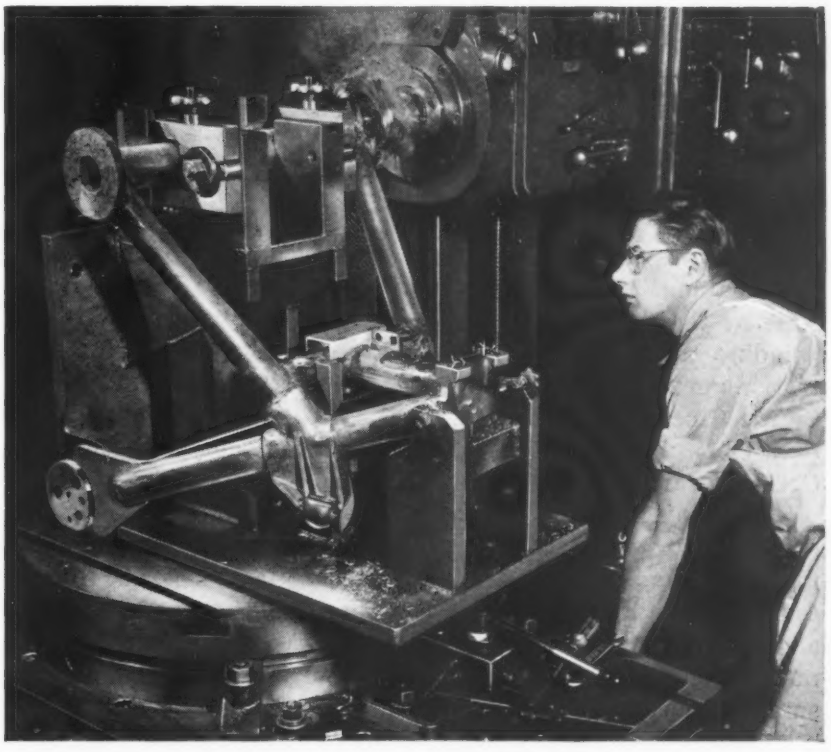
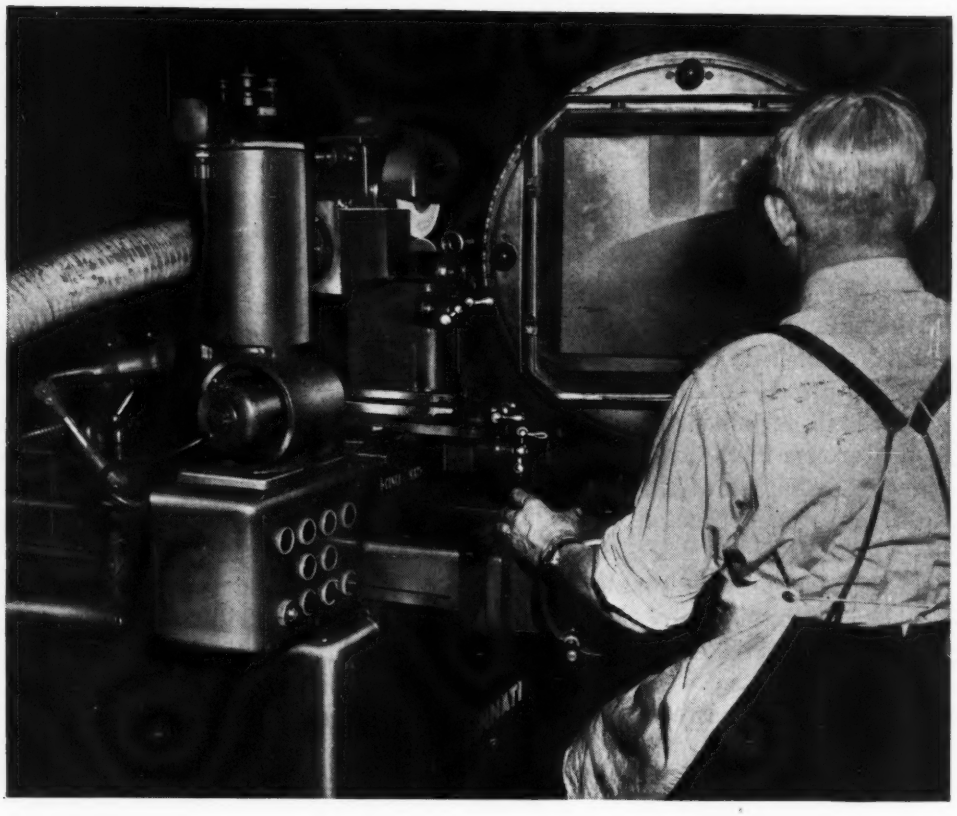


Fig. 2. Machining of the Mounting Surfaces on a Horizontal Boring, Milling, and Drilling Machine Completes the Manufacturing Operations

Optical Grinding—The Latest



Extremely Accurate Profile Shapes on Parts Such as Form Tools, Lamination Dies, and Templets are being Ground Quickly and Economically by Means of Optical Grinding Machines

By CHARLES H. WICK

CONTROL of a grinding operation by directly comparing an optically enlarged image of the work with an enlarged-scale drawing is a new idea in precision tool- and gage-making. Such control has been made possible by the development of the Projecto-Form grinding machine, shown in the heading illustration and in Fig. 1, which is manufactured by the Cincinnati Milling Machine Co., Cincinnati, Ohio, under license from the Weldon Tool Co., Cleveland, Ohio.

The Projecto-Form machine, designed for grinding extremely accurate profile shapes, simultaneously accomplishes work previously performed on both a profile grinding machine and an optical comparator. Several companies are now using this method for grinding the profile surfaces of carbide and steel cutter tips, lamination dies, masters for profiling operations, templets, and flat or circular form tools.

The method of obtaining an optically enlarged image of the work is shown diagrammatically in Fig. 2. A photomicrograph type projection light bulb *A* is enclosed within a lamp housing at the left of the operator's position *B*. The bulb draws current from a special 30-volt transformer, and is partially surrounded by an asbestos liner *C* and ventilating ducts *D*, which carry off the heat emitted by means of a blower mounted in the base of the lamp housing.

Two condenser lenses *E* focus the concentrated light from the bulb and direct parallel rays of light across the top of work *F*. To the right of the work is a prefocussed lens *G*, which projects a magnified image of the work on an optically flat mirror *H*. This mirror reflects a non-trans-

Development in Toolmaking

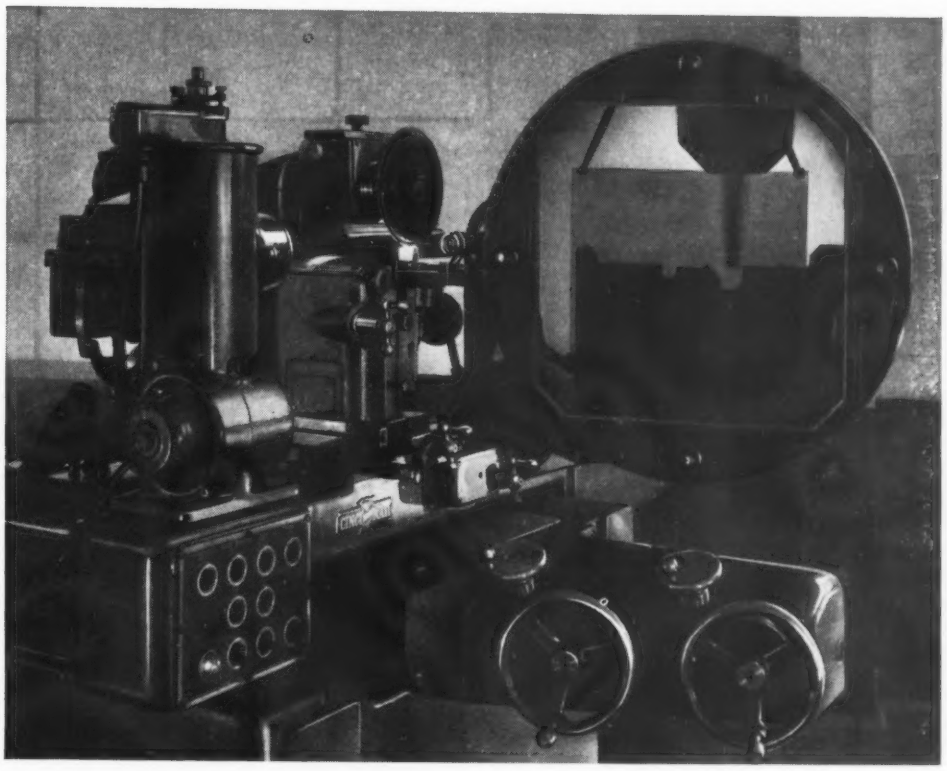


Fig 1. A Typical Profile Grinding Operation as Seen from the Operator's Position on a Projecto-Form Machine

posed image of the work onto a ground glass viewing screen *J*, directly in front of the operator. The magnification ratio can be changed from 20 to 1 to 40 to 1 by simply replacing the projection lens.

The projection system, from lens *G* to the viewing screen, is enclosed in a light-proof hood, so that a clear image will be visible on the screen even when the machine is operated in a normally lighted room. An enlarged outline *K* of the desired work profile, accurately drawn to the scale of the magnification, is mounted directly behind the viewing screen for comparison with the projected image of the work while grinding.

This drawing of the desired profile is preferably made on a glass plate, coated on one side with a green-tinted translucent emulsion. By accurately cutting away the emulsion, a bright line of the desired profile can be clearly seen on the viewing screen in contrast with the dark projected shadow of the work.

Such drawings can be accurately made on the Cincinnati lay-out scribing machine, which was also originally developed by the Weldon Tool Co. This scribing machine is shown in use in Fig. 3 at the Wood-Ridge, N. J., plant of the Wright Aeronautical Corporation. The lines are scribed by means of a non-rotating, carbide-tipped stylus, mounted in a holder that can be precisely located with reference to two scales (Fig. 4), each equipped with a vernier reading to 0.001 inch. The drawing is thus made within extremely close limits of accuracy, since it is twenty times larger than the desired profile on the work. The stylus can be moved either longitudinally or transversely along accurately machined ways producing exactly straight lines.

The 7/16-inch diameter shank of the carbide stylus fits into a hardened, ground, and lapped hole in the steel holder. The cutting end of the stylus is triangularly shaped and tapered to a 0.004 inch wide cutting tip. With a 20 to 1 magnification, the 0.004 inch wide scribed line represents only 0.0002 inch on the work-piece. Tolerances as close as plus or minus 0.0001 inch are being maintained in grinding certain work.

The scribing tool can be transferred to a holder on the beam-compass type trammel bar, shown at the upper right in Fig. 4, for scribing circular arcs or contours. Also, a microscope can be mounted in the scriber-holder for relocation over previously scribed lines or location of

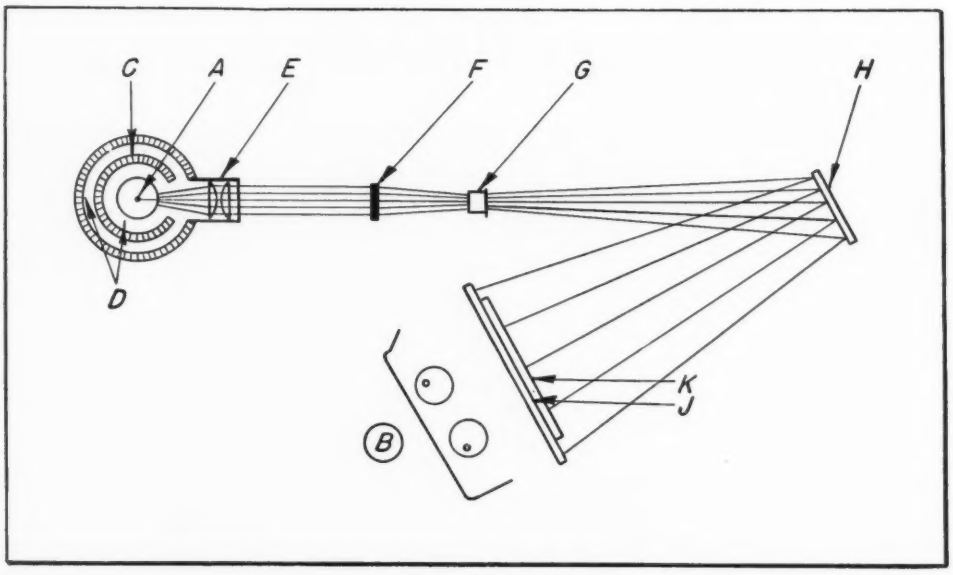


Fig. 2. Diagrammatic View of the Set-up Employed on Projecto-Form Grinders for Obtaining an Optically Enlarged Image of Work-piece F on Viewing Screen J

the center of swivel for the trammel bar. The glass plate to be scribed is taped to the rotary table, which can be positioned angularly by a separate vernier arrangement.

For grinding flat pieces, such as templets, die sections, and form tools, the work is held stationary after its image has been aligned with relation to the master drawing on the viewing screen. The support unit, to which the work or a special work-holding fixture is clamped, can be adjusted longitudinally, transversely, and vertically or swiveled 45 degrees each side of center.

After the projected image has been accurately located with reference to the master drawing, the work-slides are locked in position by means of clamping screws. The grinding-wheel head can be adjusted vertically to bring it in contact with and feed it toward the work, and transversely to feed it across the form being ground. Two handwheel controls for each of these slides are mounted on a bracket directly in front of and below the viewing screen, as seen in Fig. 1. The larger handwheels, used for setting up, move the grinding wheel 0.125 inch per revolution, while the smaller handwheels, employed for fine feeds, move the wheel 0.001 inch per revolution. Also, for flat work, the wheel-head is reciprocated longitudinally by hydraulic means. The length of longitudinal stroke is adjustable to suit the length of the part being ground, and the rate of reciprocation can be infinitely varied in both directions to give the desired surface finish.

The reciprocating slide of the wheel-head unit can be swiveled both horizontally and vertically to grind the relief angles on cutting tools, die

Fig. 3. Lay-out Scribing Machine for Making Enlarged Drawings on Emulsion-coated Glass of the Profile to be Ground

surfaces, and similar parts without changing the position of the work in relation to the optical system. Since the wheel-spindle is rotated at 3600 R.P.M., the 7-inch diameter grinding wheel commonly used has a surface speed of about 6600 feet per minute.

The viewing screen size is 18 inches square. The size of work that can be seen on the screen at one time, with a 20 to 1 magnification, is 0.900 inch wide by 0.837 inch high. By shifting the work-holding unit, the total work area that can be covered is 4.900 inches wide by 2.237 inches high. With a 40 to 1 magnification, a unit area 0.450 inch wide by 0.418 inch high can be viewed at one time, and a total work area of 4.450 inches

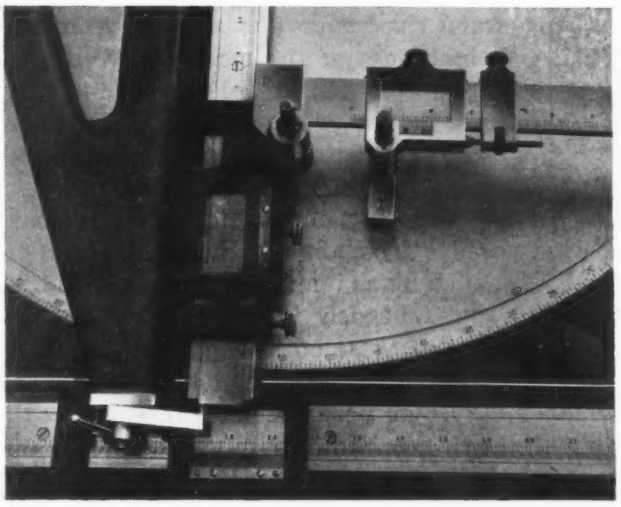


Fig. 4. Close-up View of Graduated Scales and Verniers Provided on Lay-out Scribing Machine, Fig. 3, for Accurately Positioning Scribing Tool

wide by 1.918 inches high can be covered by repositioning the work.

In preparing carbide-tipped tools for grinding, the steel shank or body of the tool is relieved about 0.010 inch below the surface of the carbide, so that the diamond wheel will not come in contact with the steel. The Weldon Tool Co. grinds many of its smaller carbide-tipped tools from the solid, without pre-forming.

The steel shank or body is cut away in preparation for brazing the carbide tips or blanks. In the case of circular tools, they are cylindrically ground after brazing to bring the carbide blanks roughly to the required diameter.

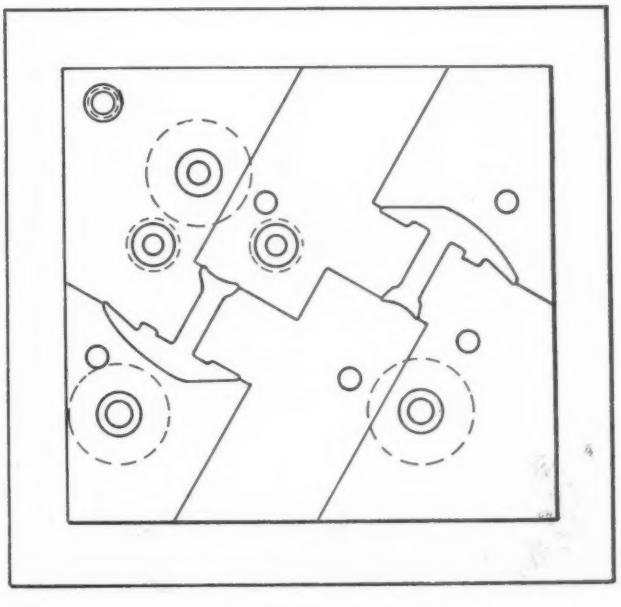
The Weldon Tool Co. has found that resinoid-bonded diamond grinding wheels of 100 concentration, having a 1/8-inch depth of diamond penetration, are most suitable for grinding carbides on the Projecto-Form. A grit size of 100 is used for roughing operations, while either 150 or 220 grit is employed for finishing, depending upon

Fig. 5. Carbide Lamination Die, the Contour Surfaces of which are Ground to Close Tolerances on the Projecto-Form Machine

the surface finish desired. Molded- or dressed-form diamond wheels can sometimes be used to advantage for semi-production runs. Since the dressing of a diamond wheel to a complex profile may require as much as eight hours, substantial savings can be made on small lots by using an unformed wheel. In some cases, two wheels can be mounted side by side on the spindle to save the time required for changing wheels.

Carbide can be hogged out in roughing operations at surprisingly high rates by using very

Fig. 6. Carbide Portion of the Lamination Die, Fig. 5, Showing Sectional Construction



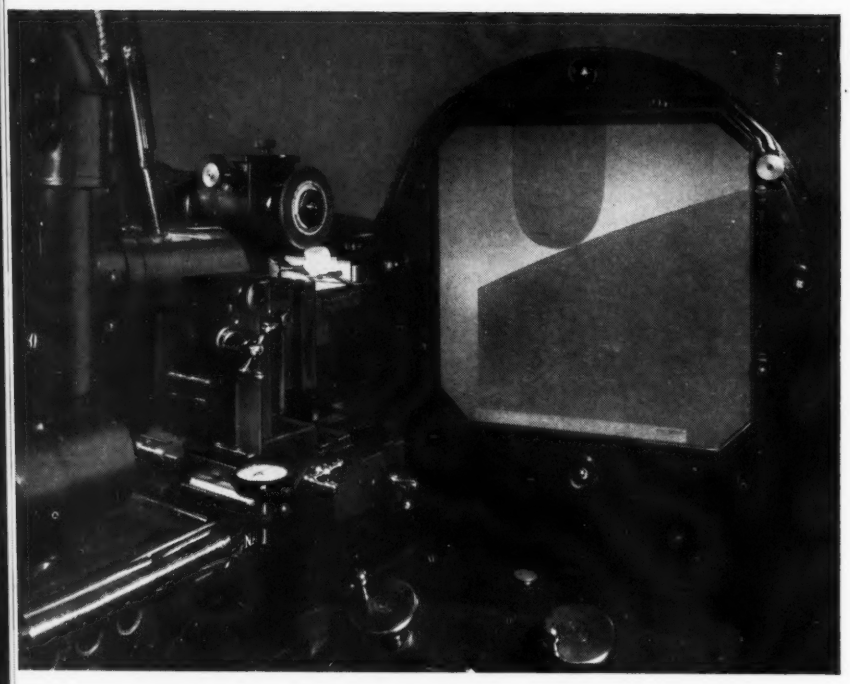


Fig. 7. Hardened Gage Stock Templet being Optically Ground. Because of Its Length, the Templet Must be Shifted and Ground in Three Sections

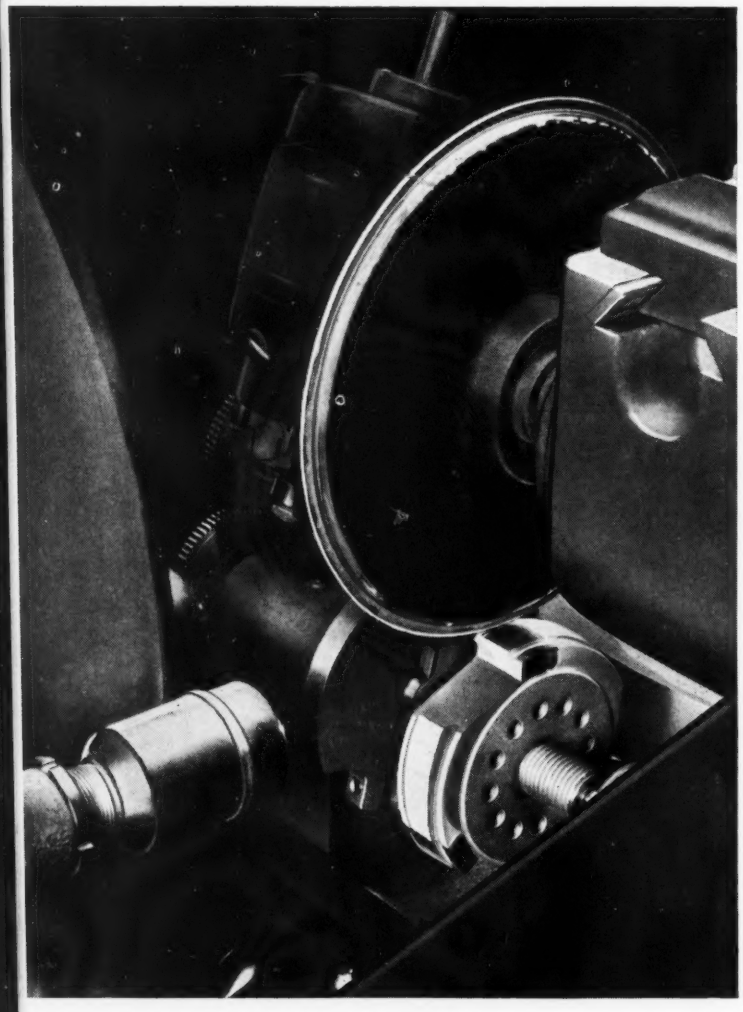


Fig. 8. Circular Form Tools are Ground on the Projecto-Form by Means of This Attachment, which Rotates the Work below the Grinding Wheel

narrow wheels, generally about 0.040 inch thick. It is necessary, however, to make such thin wheels as rigid as possible by mounting large-diameter flanges on each side of the wheel. Plunge cuts as deep as 0.010 inch, with a cross-feed of 0.003 to 0.004 inch per stroke have been made on thin work without undue wear of the diamond wheel or damage to the carbide.

For average roughing operations on flat work, the wheel is reciprocated past the work at the rate of 60 to 70 strokes per minute, and fed across the work at about 0.003 inch per stroke; the depth of plunge cut is 0.005 inch. For finishing, when the image of the work nears the bright lines of the master drawing, the depth of cut is reduced to 0.0005 to 0.001 inch, the reciprocation is slowed to about 20 strokes per minute, and the cross-feed remains 0.003 inch per stroke.

Multiple grinding of thin flat work is sometimes possible by clamping the work-pieces together. As many as ten flat die plates have been ground simultaneously in this manner.

Operators of these optical grinding machines soon learn how to generate skillfully various shaped curves and chamfers. This involves the simultaneous rotation of both vertical and transverse grinding-wheel controls in proper relation to each other. For example, to generate a 45-degree chamfer, both these handwheels are rotated in unison at the same rate, while to grind a 30-degree chamfer, the transverse handwheel has to be revolved almost twice as fast as the vertical-movement handwheel. To grind a rounded corner, an edge of the wheel is dressed to a smaller radius than the one desired on the work, and both handwheels are rotated in the proper ratio to keep the rounded edge of the grinding-wheel image in contact with or parallel to the bright line on the viewing screen.

Templets used in making master models for the profile milling of gas-turbine blades are optically ground to close tolerances at the Wright Aeronautical Corporation's Wood-Ridge plant. Flat surfaces of the hardened tool-steel templets are finish-ground prior to optical grinding for accurate location. One of the three holes in the templet is accurately located within close limits on a jig-boring machine. This "construction" hole must be tangent to each of the four sides

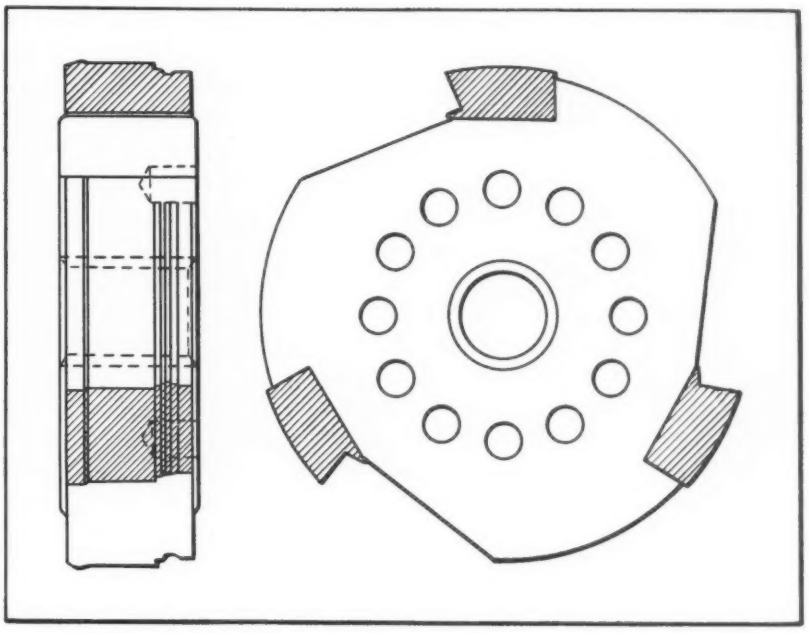


Fig. 9. The Tips of the Circular Form Tool Shown are Ground to Shape on the Machine Illustrated in Fig. 10 from Solid Carbide Blocks which have been Brazed to the Steel Body of the Tool

of a square on the master drawing before optical grinding.

The contour surface of the templet is rough-ground on a conventional tool grinder by pasting either a tracing or the original full-size drawing of the form directly on the steel blank. An allowance line approximately 1/16 inch wide is made on the form drawing to allow ample stock for finish-grinding. The drawing is removed prior to optical grinding. The templets are then finish-ground on the Projecto-Form machine, as shown in the heading illustration.

Manufacture of the intricate lamination die, Fig. 5, was greatly facilitated by the use of a Projecto-Form machine at the plant of Lincoln Park Industries in Lincoln Park, Mich. The blanking portion of this stator lamination die, shown at the left and in Fig. 6, was made from sections of solid carbide to facilitate grinding. Mating faces of the die sections were lapped to permit close fitting assembly without setting up strains in the carbide. To accurately hold the stator laminations to size, no back taper or draft was provided on the sides of the die openings. On account of this construction, the laminations cannot be pushed through the blanking die. Instead, after blanking, they are pressed back in the strip stock by pressure pads shown extending from the blanking-die openings. The hardened and ground tool-steel punch and die shown

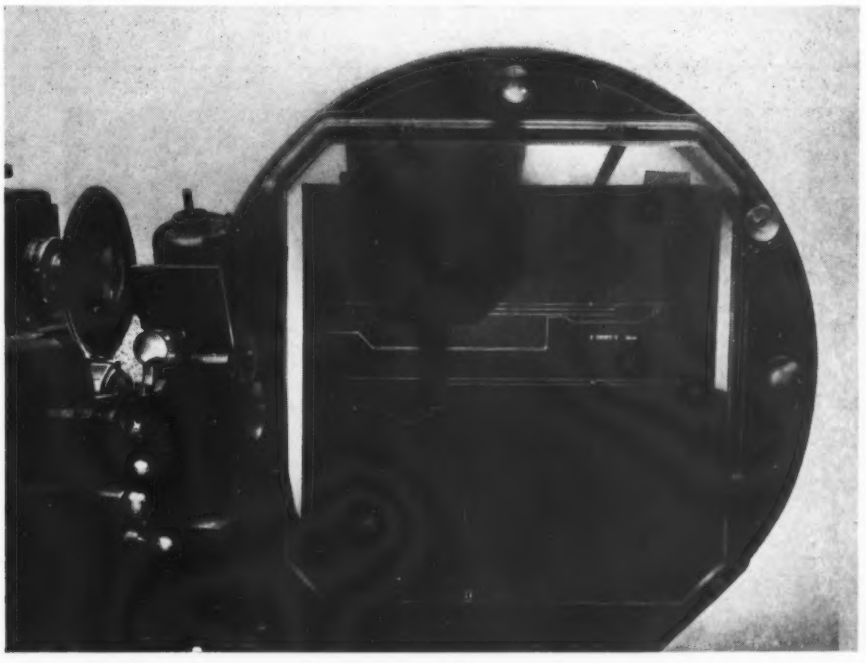


Fig. 10. Set-up for Grinding the Circular Form Tool Shown in Fig. 9. The Tool is Rotated at 50 R.P.M. for Rough-grinding and at 30 R.P.M. for Finishing

at the right of the die set are used to remove the blanked laminations from the strip stock and push them down through the die onto stackers.

Flat surfaces of the die sections and punches were finished on a surface grinder. The contours and rounded corners of the parts were precision-ground on the Projecto-Form. A 180-grit, resinoid-bonded diamond wheel, 6 inches in diameter by 3/32 inch wide, was employed. The depth of plunge cut was 0.002 inch for rough-grinding, and the wheel was reciprocated at the rate of 35 strokes per minute and traversed across the part at about 0.002 inch per stroke. For finish-grinding, the depth of cut was reduced to 0.0001 inch and the reciprocation rate to 20 strokes per minute. The cross-feed rate remained the same. To complete the work, the operator simply continued grinding until the work image coincided with the bright lines on the screen.

Complex contours on flat templets are quickly ground with this type of machine, as seen in Fig. 7. The templet shown was made by Lincoln Park Industries from hardened gage stock for inspecting the lower camber profile of turbine nozzle vanes. The flat gaging surfaces of the templet were finished on a surface grinder, while the contour surface was finished in three steps on the Projecto-Form employing a 20 to 1 magnification. The templet was clamped to a fixture on the work-supporting unit by two C-clamps. Vitrified-bond, aluminum-oxide grinding wheels, 5 inches in diameter by 1/4 inch thick, were used to grind this steel part. A 60-grit, J-hardness wheel was employed for rough-grinding, while a 100-grit, L-hardness wheel was substituted for finishing the templet.

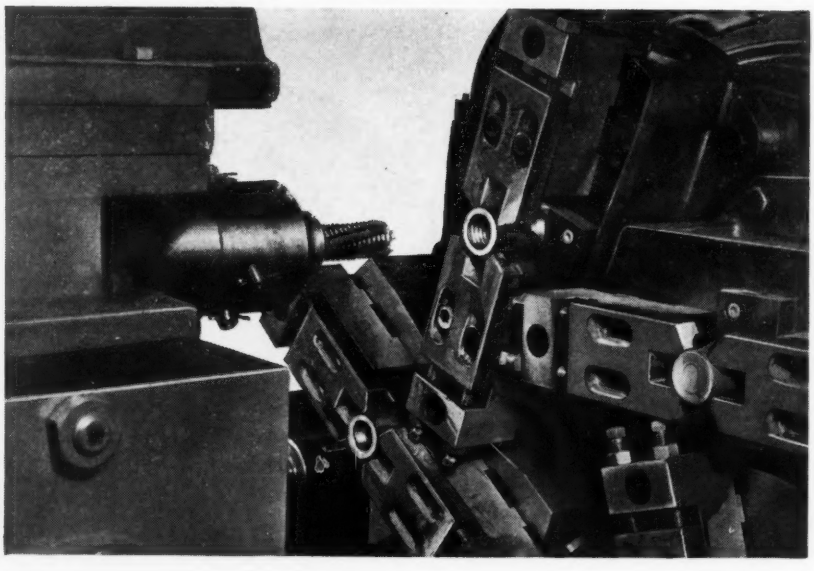
Circular form tools are being ground on the Projecto-Form machine by the Weldon Tool Co., using an attachment of the company's own design, as shown in Fig. 8. The fixture is mounted on the face of the work-holding platen. The work is mounted on a short arbor and rotated between centers by a gear drive from a separate motor. Speed of work rotation can be varied by changing the gears.

Unlike the grinding of flat work on this type machine, the wheel is not reciprocated when grinding circular work. Parts about 3 1/2 inches in diamteer or smaller are rotated at about 30 R.P.M. for both roughing and finishing operations. Larger diameter parts are rotated more slowly for both roughing and finishing. A typical carbide-tipped circular form tool (Fig. 9), is shown being ground on the Projecto-Form in Fig. 10. Rotation of such tools does not prevent a clear image from being projected on the viewing screen.

Because of the optical system built into the Projecto-Form grinder, it was necessary to design the machine for dry grinding only. Applying coolant to the grinding wheel will result in inefficient operation, since the fluid will tend to make the flying abrasive or metal particles cling to the condenser lens. This is particularly true when grinding steel. An exhaust hood surrounding the condenser lens can be provided to remove grinding dust and generated heat.

* * *

According to the "Labor Information Bulletin," published by the United States Department of Labor, the automobile industry would be able to increase production by 10 per cent, with very few additional workers, if current material problems could be eliminated.



An Extremely Difficult Job is being Performed at the Mount Vernon, Ohio, Plant of the Timken Roller Bearing Co. with the Equipment Illustrated. The Job Consists of Tapping 6-pitch Threads in a Blind Hole in Tough Steel Rock Bits, in Addition to Rough- and Finish-drilling, Facing, and Counterboring. It is Accomplished at One Set-up on a Five-station Machine. The Blind Hole, which Ranges in Size from 7/8 to 1 Inch Inside Diameter, is Tapped in a Single Operation. The Thread has a Special Radius Form, with the Result that an Unusually Heavy Load is Placed on the One-thread Chamfer of the Tap, which is of the Bottoming Type. Although Tap Life would Normally be Short on a Job of This Kind, 15,000 Rock Bits are Produced per Tap, Using a Spiral-fluted Tap Made for This Job by the Detroit Tap & Tool Co.

Designing a Ball-Type Detent

By HENRY R. BOWMAN

RECENTLY I had occasion to design a ball type of detent, in which a ball, resting on a spring in a radial hole in a hub, is pressed against a shaft and seats in a countersunk recess in the shaft when the hub is properly located. This detent holds the hub in position, but allows it to be moved on the shaft if sufficient force is applied.

I was unable to find any reference to the proportions or design of such a detent in various standard reference works, but finally was aided by an English engineer to whom I happened to mention the problem. My design is based on information supplied by him, and conforms closely to English practice.

As shown in the accompanying illustration, a ball having one-tenth the radius of the shaft is used. The V-shaped recess was cut with a standard cap-screw countersink having an included angle of 82 degrees. The diameter of the recess was such that the ball was tangent to the sides at the edge of the recess.

It is necessary to find A, the diameter of the recess; E, the distance of the center of the ball from the plane of contact with the shaft; and C, the distance of this plane of contact from the center of the shaft.

If r, the radius of the ball, is one-tenth of R, the radius of the shaft, and angle B equals 82 degrees, then

$$\frac{A}{2} = r \cos \frac{B}{2} \qquad (1)$$

or

$$\frac{A}{2} = 0.1R \cos 41 \text{ degrees} = 0.07547R$$

and

$$A = 0.15094R$$

$$E = r \sin \frac{B}{2} \qquad (2)$$

or

$$E = 0.1R \sin 41 \text{ degrees} = 0.06561R$$

In order to find distance C, angle M must be computed:

$$\text{Sin} \frac{M}{2} = \frac{A}{2} \div R = \frac{A}{2R} \qquad (3)$$

Substituting the equivalent of A from Equation (1):

$$\text{Sin} \frac{M}{2} = \frac{0.15094R}{2R} = 0.07547$$

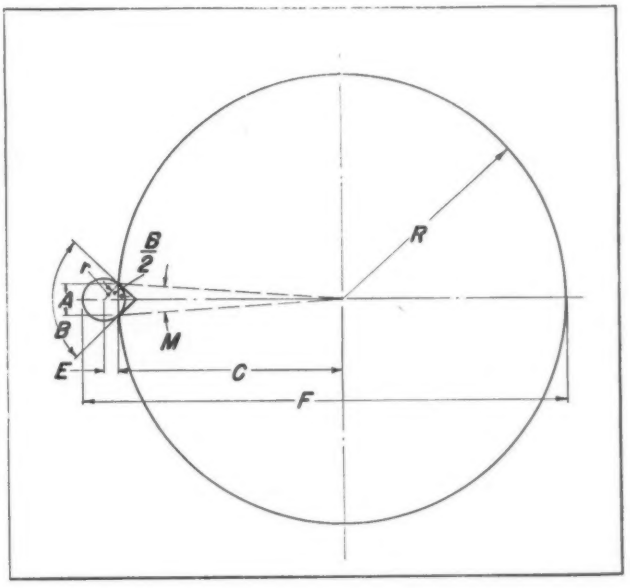
$$\frac{M}{2} = 4 \text{ degrees } 19\ 2/3 \text{ minutes}$$

$$C = R \cos \frac{M}{2} = R \cos 4 \text{ degrees } 19\ 2/3 \text{ min.}$$

$$C = 0.99715R$$

Thus, the dimension F which is used to check the position of the ball when seated in the recess is found by the formula:

$$F = R + C + E + r \qquad (4)$$



Ball Type of Detent in which Ball Radius r is One-tenth of Shaft Radius R and Recess Angle B is 82 Degrees

Substituting the equivalents for C, E, and r in terms of R:

$$F = R + 0.99715R + 0.06561R + 0.1R$$

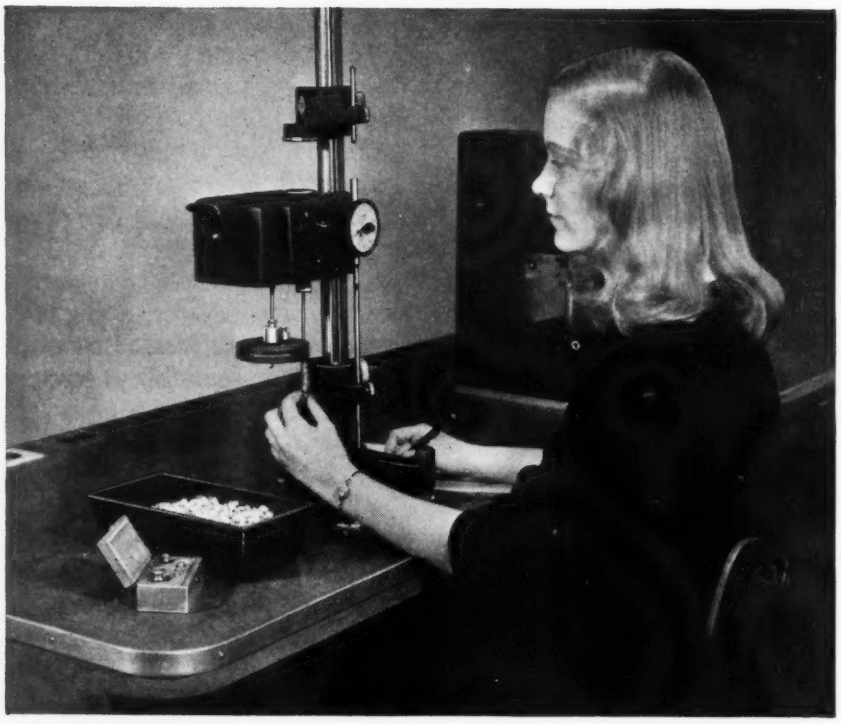
$$F = 2.16276R$$

Example—Find the diameter A of the V-shaped recess for a ball-type detent and the dimension F for checking this recess on a shaft that is 8 inches in diameter.

$$A = 0.15094 \times 4 = 0.6038 \text{ inch}$$

$$F = 2.16276 \times 4 = 8.6510 \text{ inches}$$

Producer's Quality Control Report



A Frequency-Distribution Chart, Supplied by the Producer, Helps Toward Better Quality Control of Incoming Parts and Often Reduces the Amount of Inspection Required

By G. R. ARMSTRONG
Quality Control Analyst
Hunter Pressed Steel Co.
Lansdale, Pa.

IN a great many plants, especially those engaged in large-scale production, it is impractical to inspect every incoming part to determine if it meets specifications. The most common way of determining the quality of these parts is to inspect a sample number from each lot; then, if a predetermined number of the parts tested are outside acceptance limits, the entire lot is rejected. The standard double sampling plans developed by Dodge & Romig and widely applied by the armed services during the last war are perhaps the best known examples of this approach to acceptance inspection. However, there are many types of single sampling and sequential sampling plans in use by industry. All of them are based on inspection by the "Go" and "No Go" method, which simply determines whether a part is acceptable or not.

This is "inspection by attributes," and takes no account of the degree to which the part characteristic tested is within the specified limits. A method now coming into greater favor is "inspection by variables." Here the characteristic (length, weight, chemical composition, etc.) is actually measured for each piece in the sample, and a numerical value is assigned. These numerical measures of quality for each part are charted to determine the "frequency-distribution" curve represented by the sample in relation to the specified limits.

The disadvantages of inspection by attributes —the "Go" and "No Go" method—are that the buyer may be inspecting more parts than is necessary if the "frequency distribution" of the parts is within normal limits; nothing is learned about tendencies for runs to shift toward one specification limit or the other, and no deductions can be drawn as to why the unacceptable parts are unacceptable. In any case, without knowledge of the actual distribution of measurement on sample parts, the buyer does not have a true indication of the quality of the lot.

For this reason, the Hunter Pressed Steel Co. has been furnishing its customers with frequency-distribution curves, known as quality reports, or "QR's," covering test values on all lots of coil springs that are shipped. The report shown in Fig. 1 indicates the type of product involved, the order number, the lot number, the size of the lot, the specifications that must be met, the point during the manufacturing process at which the sample of the lot was taken, the inspector, the date, and a frequency-distribution record showing the exact load at which each spring in the sample is compressed (or extended) to a specified length.

It is the loading characteristic, or force P exerted at a specified length L, that determines the quality of coil springs. In the report illustrated, one test was made on 58 parts from lot

Aids Inspection of Incoming Parts

No. 80710, a second test on 56 more parts from the same lot, and a third test on 112 parts from lot No. 82444—all cadmium-plated compression springs designed to push with a force of 200 grams when compressed to a length of 0.180 inch. The buyer specified that the allowable variation was not to exceed plus or minus 10 grams.

The shapes of the distribution humps were well defined after the tests referred to were made. Thus, there was no need to conduct further tests. If simple "Go" and "No Go" methods had been used, and standard sampling plans followed to insure less than 3 per cent of unacceptable parts, from 200 to 250 pieces would have had to be tested in each of the three cases.

Regardless of the processing that the springs have received, each lot that is ready for shipment is sampled and tested, including those that have been 100 per cent tested. The inspector selects at random a sample of from 50 to 200 pieces from each lot, depending upon the lot size. Each of these pieces is then tested on a "load tester," shown in the heading illustration, in which the spring is compressed or extended to the exact length specified, as read on the dial indicator, by adjusting the weights on the pan. The force P necessary to compress or extend the spring to the specified length is thus measured. Each reading is recorded by a tally mark on the QR form.

The frequency-distribution curve is thus developed, and the testing is stopped when its shape is clear. Then a photostat of the final sheet is forwarded to the customer, and the inspection tag that accompanies the shipment of springs is marked with the number of the QR sheet, so that it can easily be identified.

Value to the Customer and to the Producer

The shape of the distribution curve, its spread with respect to the tolerance limits, and its position between the minimum and maximum limit

QUALITY REPORT No. 4823

PRODUCT COMPRESSION SPRING CUSTOMER — QUOT. No. 87884-B
CHARACTERISTIC P @ L OF 0.180" PART NO. 9008243 REF.
INSP. METHOD 217-PM SPECIFIED LIMITS 200 GRAMS ± 5% @ 0.180"
SAMPLE DRAWN AFTER CAD. PLATE EQUIV. INSP. LIMITS 190 - 210 GRAMS @ 0.180"

HPS ORDER No		80710 (15M)		82444 (5M)
CUSTOMER ORDER No.		116649		117243
INSPECTED BY		RHD	E.B.C.	V.G.S.
DATE		1-6-48	1/7/48	2-9-48
FORCE (P)		LOT 1	LOT 2	
	MIN.			
190				
2		II	II	II
4		𝍸 IIII	𝍸 II	𝍸 III
6		𝍸 𝍸 𝍸 II	𝍸 𝍸 IIII	𝍸 𝍸 𝍸 III
8		𝍸 𝍸 𝍸 I	𝍸 𝍸 𝍸 III	𝍸 𝍸 𝍸 𝍸 III
200		𝍸 𝍸 I	𝍸 IIII	𝍸 𝍸 𝍸 𝍸 𝍸
2		III	𝍸	𝍸 𝍸 𝍸 II
4			I	𝍸 𝍸
6				𝍸 I
8				II
210	MAX.			I
		OK	OK	OK
		8100 PCS.	7M PCS	5100 PCS
		C.J.M.	C.J.M.	C.J.M.

HUNTER PRESSED STEEL CO. FORM 861—1M—12-17-47

Fig. 1. A Quality Report Such as Shown Here is Sent to a Customer with Each Lot of Springs. It Enables Him to Better Adapt His Incoming Inspection Plan for Each Particular Part

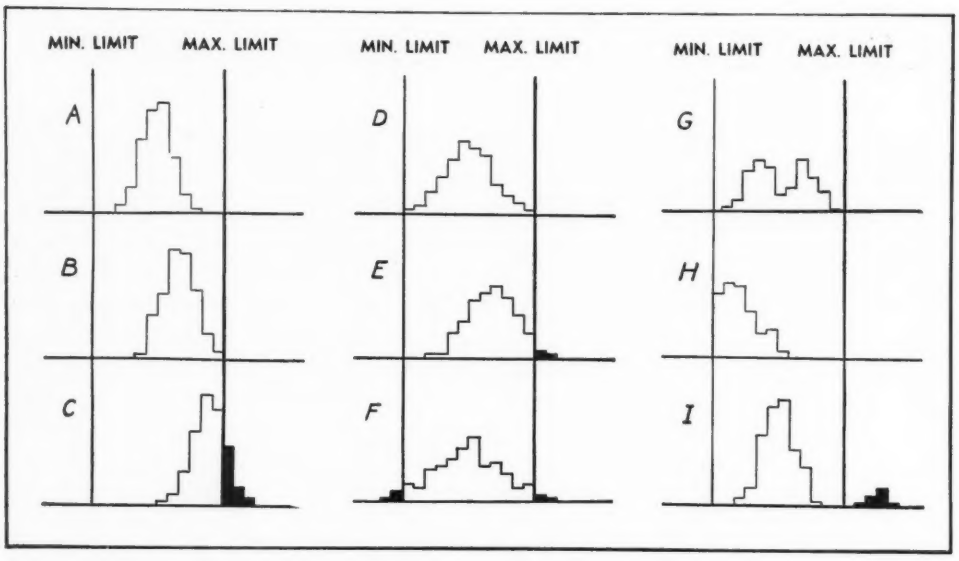


Fig. 2. Several Different Types of Frequency-distribution Curves. The Shape of the Curve and Its Position with Respect to the Tolerance Limits Provide Important Information on the Quality of the Incoming Parts

lines reveal important information to both the producer and the customer. Fig. 2 illustrates some representative case histories. The spread of the distribution hump in case *A* is sufficiently narrow and well centered to suggest that the buyer may safely use smaller samples in his own testing of incoming shipments, thereby saving time and expense. Or the specifications on this component part might be tightened, if such a move would be conducive to perfection of the assembled product. Conceivably, the manufacturer could be asked if relaxation of his manufacturing precision might not result in faster or cheaper production, since he is achieving a distribution better than needed.

If the distribution curve is off center, as in *B*, both buyer and producer will want to check back to determine the cause of the eccentricity. It might be due to improper set-up of a machine or to gradual wearing of a tool. If the condition is allowed to continue, it may eventually result in a distribution like that shown in *C*, which indicates that a substantial number of defective parts have been produced. A curve similar to *H* shows that defective parts were produced, but that the producer detailed each piece and included only good parts in the lot. Data on such lots should be kept separate from that obtained from normal undetailed lots when determining the quality level from any one supplier. Otherwise, a distorted picture of quality will be obtained.

There are times, as in case *B*, where the frequency curve is off center, and yet the product meets specifications. There also are instances, as indicated at *E*, where the curve is off center and a small number of defective parts are revealed (see also the third test in Fig. 1). Even here the product may be acceptable, depending on the buyer's quality standards. Naturally, it should be the aim of the manufacturer to center the curve, although unless an off-center distribution shows parts beyond the acceptable limits, the buyer need have little concern. In fact, there are occasions where it may be necessary for production reasons to run off center deliberately.

In case *D*, the distribution range is well centered and the spread of the curve corresponds exactly to the limits specified. This is the ideal condition, in that production costs are not increased by making parts to closer limits than specified. However, a slight change in the setting of a machine might result in the production of defective parts, as in case *E*. When a distribution curve of this nature is obtained, the supplier must balance the cost of the occasional detailing of each part in bad lots against the cost of manufacturing to closer tolerances. The buyer, on the other hand, may be able to widen the limits in order to insure all good parts, particularly if the component is not critical in the operation of an assembly.

In case *F*, either the supplier of the product must radically improve his manufacturing methods or the buyer increase his allowable tolerances. Often this condition exists because unnecessarily close tolerances are specified by design engineers. It may also, however, represent the output of an outmoded or obsolete machine. Whatever the cause, it must be found and corrective action taken.

The remaining two distribution curves shown at *G* and *I* are abnormal in that they have a double hump. This double hump may be due to a change of tools or materials during the running of the lot, so that the curve really represents two lots produced under different conditions. Double-hump curves serve as checks in

tracking down the nature and timing of changes in manufacturing conditions. Both humps in case *G* fall within the specified limits. However, in case *I*, a small distribution is outside the maximum limit. These parts probably were produced during tool and set-up try-outs, and were not separated from the lot. This lot should be inspected 100 per cent to segregate the bad parts.

After some experience with distribution curves, the customer will be able to practically ascertain the manufacturing conditions that exist in the supplier's plant when the parts are produced. Thus, he can, on receipt of a quality report, quickly determine the quality level of the incoming lot and decide on the severity of his inspection plan. If the buyer is dealing with a reputable supplier, he may accept the report at face value and perform no inspection.

To assist manufacturers in installing suitable methods of sampling and inspecting incoming lots of parts, the Hunter Pressed Steel Co. is inaugurating a short training program that will acquaint the inspection personnel of major component buying industries with the advantages of statistical methods of quality control.

Although these statistical principles are not new, the policy of running a frequency-distribution check on each shipped lot and sending the report to the buyer is definitely an innovation. It is expected to prove a step forward for the producer, the designer, and the user of component parts.

The Detection of Cracks in Hardened Steel

WHEN cracks are present in a ground steel surface, they may be large enough to be directly visible. Frequently, however, they are too fine to be detected or they may have been covered over. Other methods are then required to reveal them.

Dr. L. P. Trasov, of the Norton Co.'s Research Laboratories, states that the most satisfactory method of detecting fine cracks is by magnetic particle inspection—Magnaflux inspection—in which the test piece is magnetized and a magnetic powder is deposited on the surface. Most of the powder particles concentrate on the cracks, which are thus clearly outlined. The reason for this behavior is that cracks are tiny air gaps and the sides of the cracks act as the poles of magnets to which the magnetic particles are strongly attracted.

Another way of bringing out cracks is to etch the steel in nitric acid at room temperature. A short etching of a few seconds' duration will not widen the cracks appreciably, and after the surface is wiped off and dried completely, the acid seeps out and discolors the surface, thus making it easy to detect the cracks. Among the etching mediums that have been used successfully are 5 per cent nital, which is 5 per cent by volume of concentrated nitric acid dissolved in ethyl or methyl alcohol; and 2 per cent concentrated nitric acid in water or one part of concentrated nitric acid to two parts of water. The proper etching medium for a particular steel can best be found by trial.

Cracks in the ground surfaces of cemented carbides usually cannot be detected by magnetic inspection. The most sensitive non-destructive method to use on such metals is one in which a fluorescent oil or other penetrant is soaked into the surface, after which the surface is cleaned, leaving the liquid in the crack. When the surface so treated is exposed to ultra-violet light, the oil that has seeped out fluoresces brightly and the cracks show up as white lines on a dark background. The equipment for this method of inspection is marketed by the Magnaflux Corporation under the trade name of "Zyglo."

Although the fluorescent method of inspection is satisfactory from the point of sensitivity, it is considered by some users to be too time-consuming for routine inspection. They have found that examination of the ground surface with a magnifying glass or low-power microscope is all that is necessary.

Etching a piece of cemented carbide with a mixture of hydrofluoric acid is a sensitive method of detecting cracks, but the acid destroys the surface of the piece while enlarging the cracks. In addition, hydrofluoric acid is highly dangerous to handle, and should be restricted to laboratory use.

* * *

In pre-war years, the automotive industry figured on reducing car-making costs about 1 1/2 per cent per year, on the average, by improved machines and methods. With the post-war increases in material, freight, and labor costs, much of the past gains have been wiped out, which accounts for the industry's increased drive toward modernization.

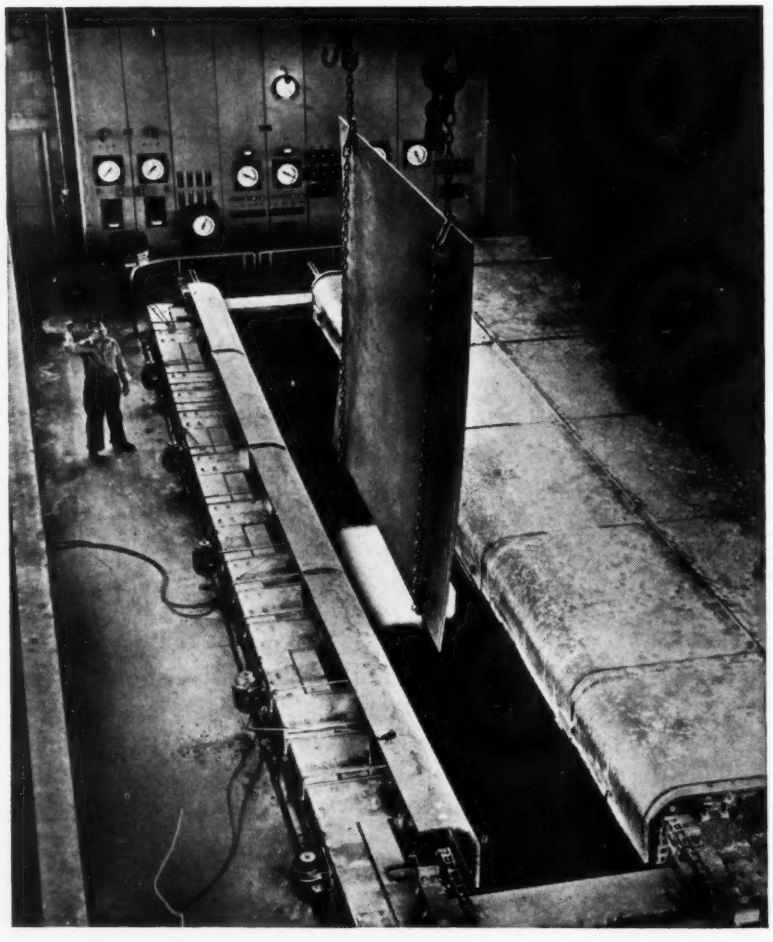
Engineering News

Largest Salt-Bath Descaling Equipment in the World

To remove scale from large hot-rolled clad-steel plates and sheets, including Monel and nickel plates, the Lukens Steel Co. recently installed, in its Coatesville, Pa., plant, molten salt-bath descaling equipment that is said to exceed in size any similar equipment in existence.

The Ajax-Hultgren electrical salt bath furnace used, made by the Ajax Electric Co., Philadelphia, Pa., is shown in the accompanying illustration. The bath tank, containing molten sodium hydroxide and sodium hydride, is 40 feet long by 4 feet wide by 11 1/2 feet deep. The furnace holds 165 tons of salt, is heated by immersed electrodes, and has a power input of 800 kilowatts.

The work to be cleaned is placed on racks in such a way that all surfaces are reached by the bath. The pieces are held in this bath, which is maintained at a temperature of 700 degrees F., from eight to twenty minutes, depending on the thickness and weight of the plates, as well as on the particular type of metal or alloy being cleaned. After the scale has been completely reduced, the hot work is immersed in water. A high-pressure water rinse is used to remove any loosely clinging materials and all traces of caustic soda. This is followed by a flash dip in acid to produce bright surfaces, and by another high-pressure water rinse to remove the acid and any smut.



Lowering a Clad-steel Plate into a Huge Salt-bath Descaling Tank Installed at the Coatesville, Pa., Plant of the Lukens Steel Co.

"Sub-Miniature" Electrical Motors Weighing Less than an Ounce

A line of "sub-miniature" electrical motors, some of which weigh less than an ounce and can be operated from flashlight batteries, will soon be put into production by the Electrotor Division of the United States Instrument Corporation, Summit, N. J. Developed by J. V. and J. E. G. Eurich, of Lancashire, England, these "Electrotors" will be used to operate portable machines, air-conditioning equipment in trains and cars, motion-picture cameras, automatic razors, radio-controlled mechanisms, stroboscopes, and many other types of equipment.

There are four sizes of "Electrotors." The smallest, which will not be made commercially, although it is practical for special highly sensitive instruments, is only 3/16 inch in diameter by 3/16 inch wide, and is thought to be the smallest electrical motor ever built. It weighs less than 1 gram, requires an operating voltage of only 1 1/2 volts, and has a speed of 7000 R.P.M. The other three sizes are 7/8 inch in diameter by 9/16 inch wide (consuming less power than a flashlight bulb); 1 1/2 inches in diameter by 3/4 inch wide (operating

on 4 1/2 to 6 volts); and 1 1/2 inches in diameter by 1 1/2 inches wide (requiring from 6 to 24 volts).

A feature responsible for the success of these motors is the new "gap-ring armature." This armature consists of a gap-ring winding, mounted on a bobbin and spindle which revolve freely within a permanent magnet. It can be considered a horseshoe electromagnet in which broken iron rings form the core, and an outer winding the magnetic coil. The contact points on the armature, whose position relative to the gap in the core determines the flux distribution, are, in effect, the brushes. Thus, the need for a separate commutator and complicated segmentary winding is eliminated.

Light-Weight Automatic Pilot for Planes Uses "Rate" Gyroscopes

An automatic pilot that maintains positive control of planes even when the component gyroscopes are forced far out of their normal position has been developed and is undergoing tests at the Research Laboratories of the Westinghouse Electric Corporation, East Pittsburgh, Pa. This characteristic, plus its ability to withstand high acceleration rates, makes the new device—the "Gyropilot"—suitable for pursuit planes or for guided missiles and pilotless aircraft, in addition to commercial planes.

The "Gyropilot" employs three separate but coordinated gyroscopes, one for each principal axis of motion. These are "rate gyros," so called because they are responsive to change in angular velocity. "Position gyros," customarily used in automatic pilots, are sensitive to change in absolute angular position. Held in gimbals, which allows them freedom of motion in all directions, "position gyros" have a tendency to tumble or lose control when forced more than about 60 degrees out of position. "Rate gyros," however, are fixed to the plane and allow it to loop the loop and barrel roll, if desired, without loss of control.

Other advantages of the "Gyropilot" are a great increase in simplicity, an in-built or direct means of providing banking control, and a reduction in power requirements.

Instrument-Ladened Plastic Balloon Will Explore Stratosphere

To explore the upper regions of the stratosphere and the ionosphere, the Aeronautical Research Laboratories of General Mills, Inc., have developed a giant plastic balloon that is capable of reaching altitudes above 100,000 feet with a payload of 70 pounds. The teardrop-shaped balloon is 70 feet in diameter and 100 feet long. It is constructed of a thin, almost flimsy, plastic film which permits it to float in air only 1 per cent as dense as air at sea level. When completely expanded, it has a gas volume of 206,000 cubic feet, but for the take-off, it is filled to only 1.3 per cent of its capacity. As the balloon rises, this small bubble of gas expands and completely fills the plastic envelope at an altitude of about 20 miles.

It is planned, as research progresses, to send up instruments to measure cosmic rays, air temperatures, the force of gravity, air composition, ozone concentration, and other phenomena. These instruments will telemeter their information to recording stations on the ground, where the signals will be picked up by receivers and recorded. Much invaluable data will thus be obtained to aid scientists in maintaining this country's aircraft supremacy. Developed under contract with the Office of Naval Research, the balloon is still in an experimental stage.

New Boeing Jet Bomber Carries 10-Ton Bomb Load

A new Boeing jet bomber which is as large as the famous B-29 Superfortress and is capable of carrying a 10-ton bomb load at speeds of 500 miles per minute or more is being tested by Boeing engineers at the Moses Lake Air Force Field in Washington.

This "XB-47 Stratojet" is said to have the greatest power potential of any airplane in the world. It is propelled by six turbo-jet engines, each of which is capable of developing 4000 pounds of thrust, and eighteen rocket motors, each rated at 1000 pounds thrust, or a total of 42,000 pounds of thrust.

The rocket motors are mounted integrally on each side of the airplane, near its tail, to provide auxiliary power during heavy load take-offs and in emergencies. Four of the turbo-jet engines are mounted in pairs under the inboard wing, and the other two units are mounted near each wing tip.

To permit safe operations at speeds close to that of sound, the wings sweep back at an angle of 35 degrees, thus retarding the violent shock waves that build up around a normal wing when approaching such velocities. An unusual feature of the big airplane is the use of retractable slats on the leading edge of the wings to maintain lateral control at low speeds. The plane is operated by a crew of three.

Set-Ups for

Examples Showing Procedures in Sharpening Milling Cutters, End-Mills, Formed Cutters, and Similar Tools — Second of Two Articles

By
FREEMAN C. DUSTON

METHODS and equipment used in sharpening plain and helical milling cutters, employing both straight and flaring cup-wheels, were described and illustrated in March MACHINERY, page 150. The present article contains additional illustrations and descriptions of set-ups for sharpening different types of cutters on the Brown & Sharpe No. 5 cutter and tool grinding machine.

In Fig. 10, an operator is shown actuating the table feed knob of the cutter-grinding machine with his right hand while using his left hand to index the cutter from tooth to tooth and to guide the tooth along the tooth-rest during the grinding and return strokes. A flaring cup-wheel is being used in this set-up for grinding the primary or secondary angle clearances on the peripheral teeth of a right-hand coarse-tooth helical milling cutter mounted on a mandrel held between centers on the table of the machine.

In grinding a small straight-shank spiral end-mill between centers, as shown in Fig. 11, it will

Fig. 10. Using Flaring Cup-wheel to Grind Primary or Secondary Angle Clearance on Peripheral Teeth of Right-hand Coarse-tooth Helical Milling Cutter. Cutter is Mounted on Mandrel Held between Centers

Fig. 11. Using Flaring Cup-wheel to Grind Primary Angle Clearance on Peripheral Teeth of Small End-mill with Left-hand Helical Teeth. The Straight-shank Tool is Held between Centers

Grinding Milling Cutters

be noted that the operator stands in a comfortable position at the left-hand end of the table. In this position, she has a clear view of the work while operating the table feeding lever with the left hand and performing the guiding and indexing operations with the right hand. This change from the usual operating position is made possible by the fact that the operating handles or knobs can be applied at either end of the table and on either side of each end.

The operating position shown in Fig. 11 greatly facilitates the sharpening of milling cutters and end-mills having left-hand helical teeth. This illustration also shows how the grinding-wheel column of the B & S No. 5 cutter grinder can be moved on its base to allow longer work to be handled without increasing overhang of the table. This feature also allows the operator to take a more natural position closer to the work, even permitting small, delicate cutters to be sharpened while the operator is comfortably seated, as shown in the heading illustration, which also shows how the work-head is used to hold small cutters. The operation performed in this case consists of grinding the primary clearance on the peripheral teeth of a small left-hand helical-tooth end-mill held in the work-head. Spring-backed table dogs like those shown at the front of the table in Fig. 12 are adjusted to control the length of the grinding stroke, so as to avoid interference of the wheel with the work chuck and eliminate wasting time through unnecessarily long table strokes. The spring action of the table dogs serves to reduce the operating effort when reversing the table movement.

The method of mounting a shell end-mill with right-hand helical teeth on the work-head at the right-hand end of the table, for sharpening the primary clearance on the peripheral teeth, is shown in Fig. 12. Fig. 13 illustrates the method of using a raising block to avoid interference of the flaring cup-wheel with the tooth above the one being sharpened when grinding the secondary clearance angle. A set-up for handling the cutter-grinding job shown in Fig. 12 using a straight wheel in place of the flaring cup-wheel is illustrated in Fig. 14.

A set-up for grinding primary or secondary clearance on the end cutting teeth of a shell end-mill held in the work-head, using a flaring cup-wheel, is shown in Fig. 15. With this set-up, the wheel runs onto the cutting edge, producing no burrs and showing less tendency to heat the cutting edge. The set-up is greatly facilitated by the T-slot provided on the work-head housing for mounting the tooth-rest.

In Fig. 16 the work illustrated in Fig. 15 is shown swung around and tilted to the correct angle for grinding primary or secondary clearance on the corner teeth of the shell end-mill.

Fig. 12. Set-up of Cutter-grinding Machine for Grinding Primary Clearance Angle on the Peripheral Teeth of Helical-tooth Shell End-mill Held in Work-head, Using a Flaring Cup-wheel

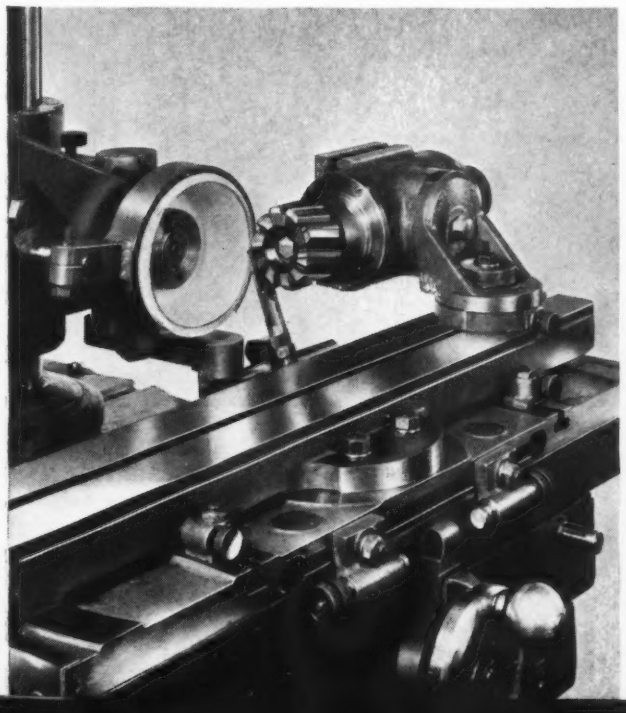
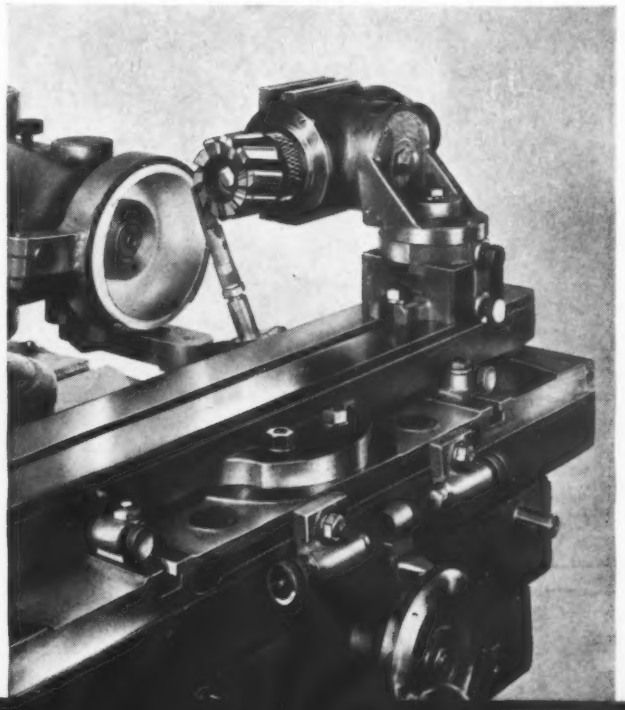


Fig. 13. Set-up for Grinding Secondary Clearance Angle on End-mill Shown in Fig. 12, Using Raising Block under Work-head to Permit Wheel to Clear Tooth above One being Ground with Cup-wheel



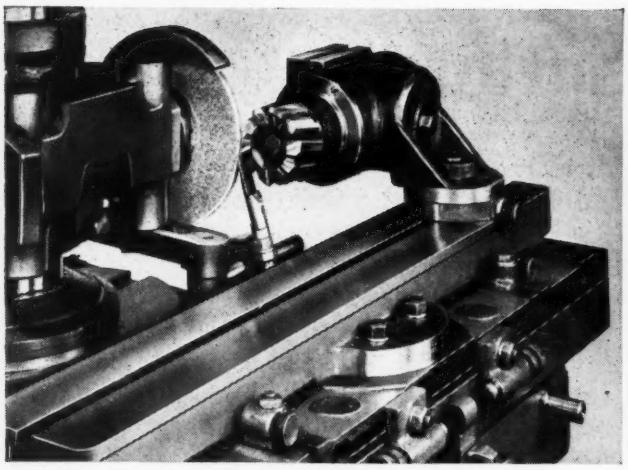


Fig. 14. Set-up for a Similar Job to that Illustrated in Fig. 12, Using a Straight Grinding Wheel

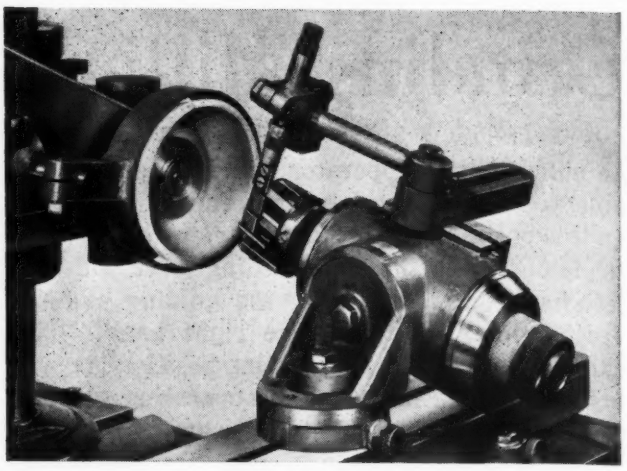


Fig. 15. Set-up for Grinding Primary or Secondary Angle Clearance on End Teeth of a Shell End-mill

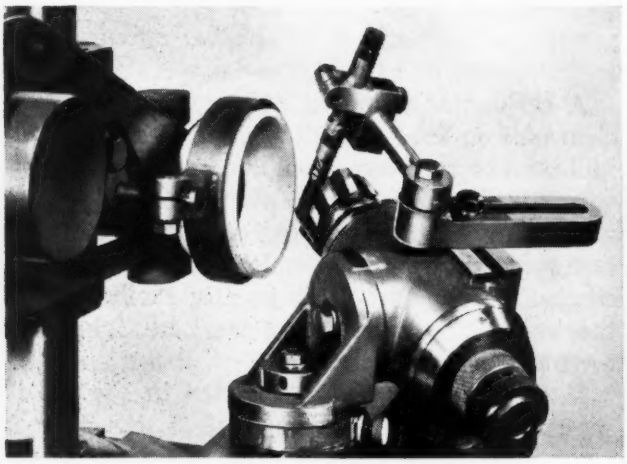


Fig. 16. Set-up in which End-mill is Swung around and Tilted to Correct Angle for Grinding Primary or Secondary Angle Clearance on Corner Teeth

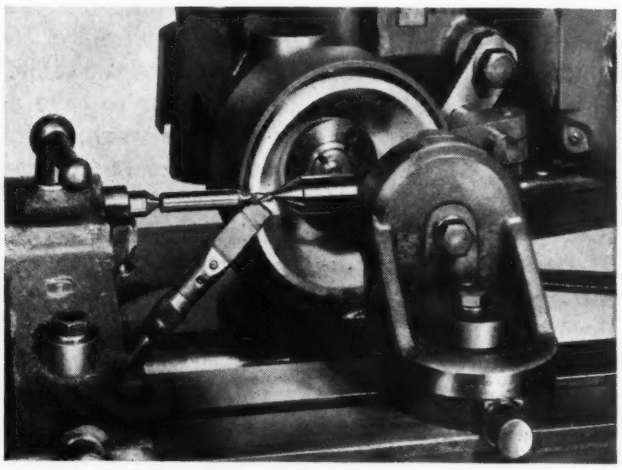


Fig. 17. Small Straight-shank End-mill Mounted between Centers for Grinding Primary or Secondary Clearance Angle on Left-hand Helical Teeth

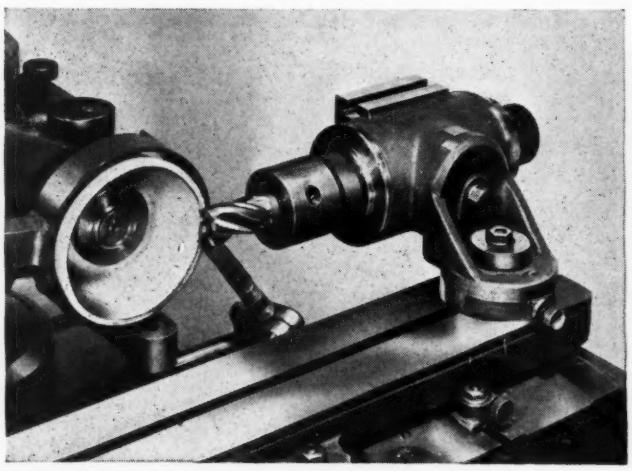


Fig. 18. Large Right-hand Helical-tooth End-mill, with Milling Machine Standard Taper Shank, Held in Work-head for Grinding Primary or Secondary Angle Clearance on Peripheral Teeth with Flaring Cup-wheel

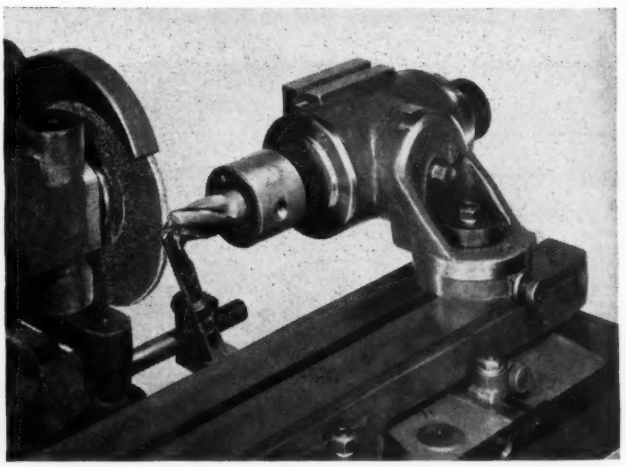


Fig. 19. Large Right-hand Helical-tooth End-mill, with Milling Machine Standard Taper Shank, Held in Work-head for Grinding Primary or Secondary Angle Clearance on Peripheral Teeth with Straight Wheel

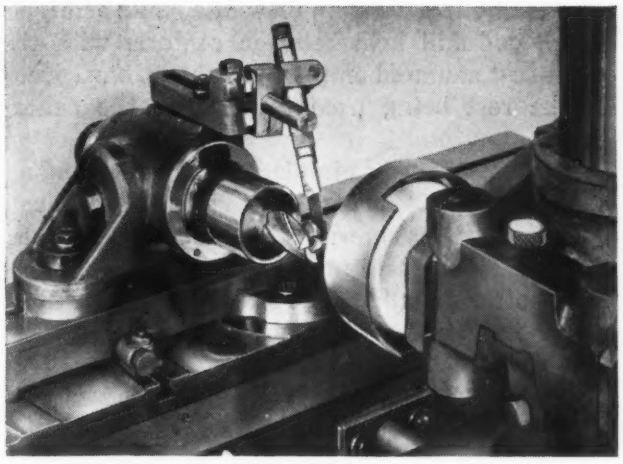


Fig. 20. End-mill, with Milling Machine Standard Taper Shank, Held in Work-head for Grinding Primary Clearance on End Teeth with Flaring Cup-wheel

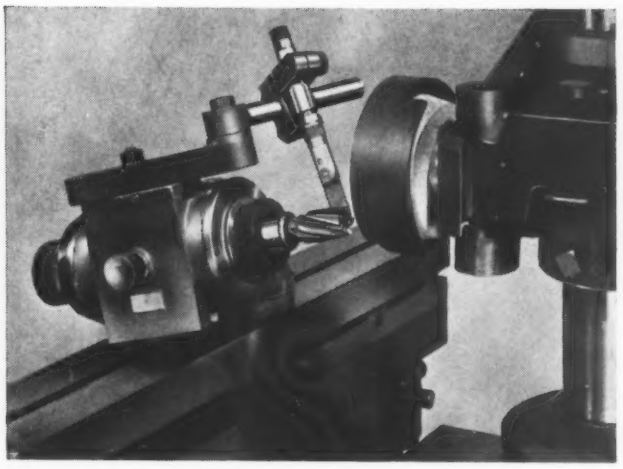


Fig. 21. Large Right-hand Helical-tooth End-mill, with B & S Taper Shank, Mounted in Work-head for Grinding the Secondary Clearance Angle

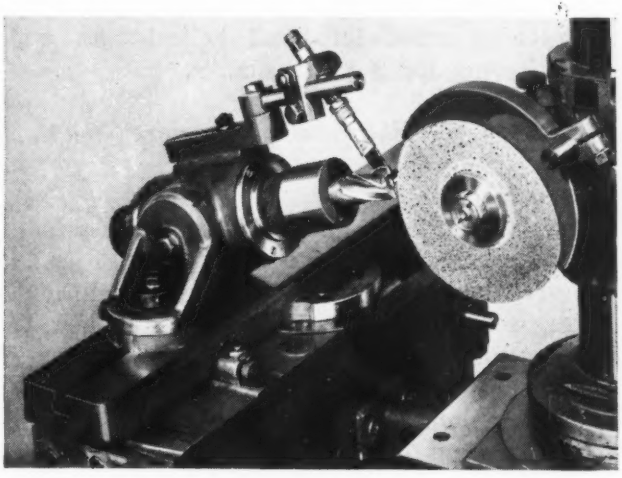


Fig. 22. End-mill, with Milling Machine Standard Taper Shank, Mounted in Work-head for Grinding the Secondary Angle Clearance on the End Teeth with a Straight Wheel

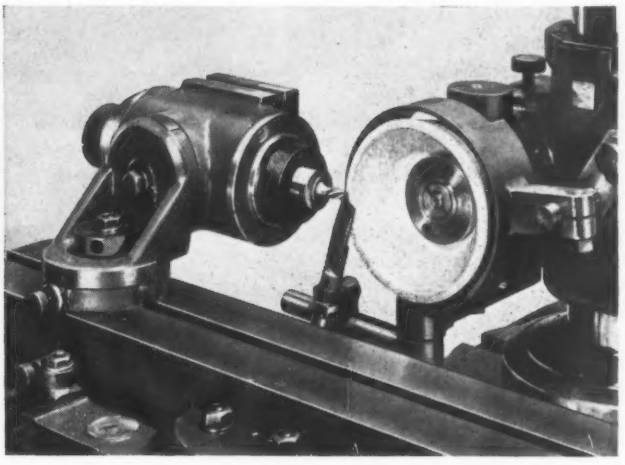


Fig. 23. Small Left-hand Helical-tooth End-mill, with B & S Taper Shank, Held in Work-head for Grinding Primary or Secondary Angle Clearance on Peripheral Teeth with Flaring Cup-wheel

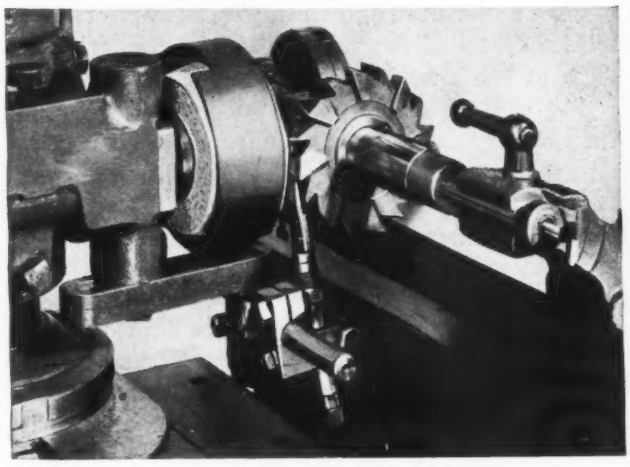


Fig. 24. Set-up for Grinding Primary Clearance on Peripheral Teeth of Staggered-tooth Side Milling Cutter with Flaring Cup-wheel

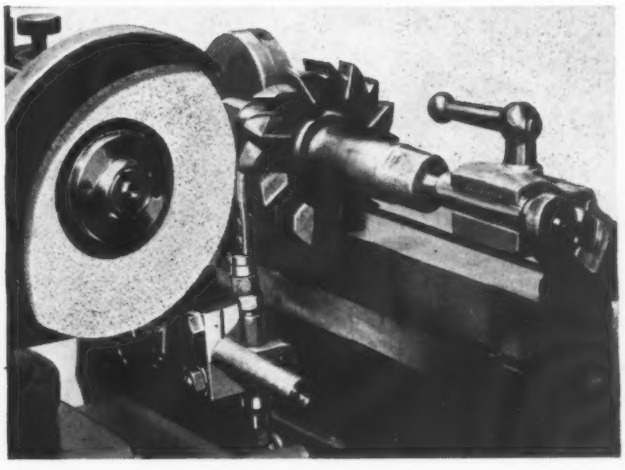


Fig. 25. Set-up for Grinding Primary Clearance on Peripheral Teeth of Staggered-tooth Side Milling Cutter with Straight Wheel

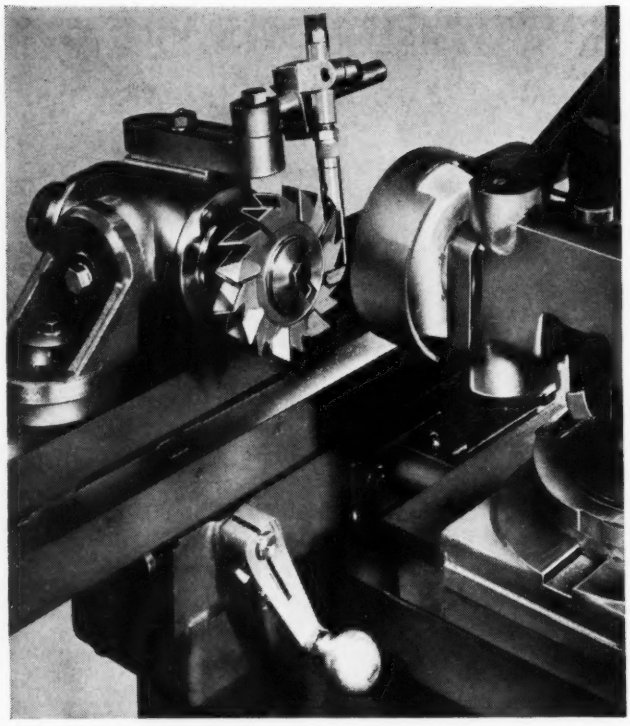


Fig. 26. Staggered-tooth Side Milling Cutter Held in Work-head for Grinding Primary or Secondary Angle Clearance on Side Teeth with Flaring Cup-wheel

Fig. 27. Formed Cutter Sharpening Attachment of the In-feed Type Set Up for Grinding Tooth Face of a Formed Cutter with a Dish Wheel

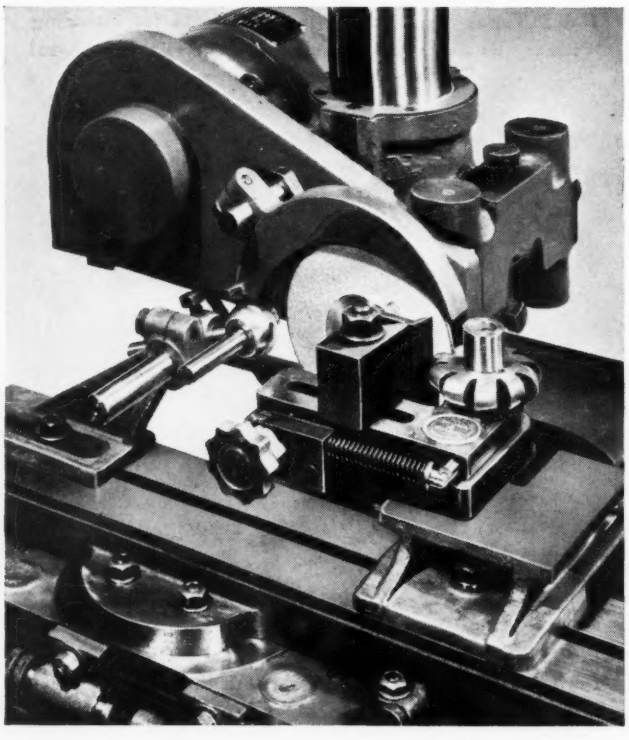


Fig. 17 shows a close-up view of a small straight-shank end-mill held between centers, with the tooth-rest mounted on the wheel-head, one corner of the rest being used to position the helical tooth.

A comparatively simple set-up for grinding the peripheral teeth of a large right-hand helical-tooth end-mill is shown in Fig. 18. Fig. 19 illustrates a set-up using a straight grinding wheel for a cutter-grinding job similar to the one illustrated in Fig. 18 in which a flaring cup-wheel was used.

Typical set-ups for grinding the end-cutting teeth of end-mills are shown in Figs. 20, 21, and 22. It is possible to use a straight wheel in the case of the cutter shown in Fig. 22 because it has only four teeth. If this cutter had been made with six teeth, it would have been necessary to use a cup-wheel, as shown in Fig. 21. The set-up illustrated in Fig. 23 is employed for sharpening small left-hand helical-tooth end-mills having B & S taper shanks.

Set-Ups for Sharpening Staggered-Tooth Cutters

In setting up for sharpening staggered-tooth milling cutters like the one shown in Fig. 24, the grinding rim of the flaring cup-wheel should be dressed to a radius of 1/16 inch, the same as for steep helical-tooth cutters, and the tooth-rest should have the form of a broad inverted vee. The vee point of the rest and the contact point of the radius-formed periphery of the wheel should be accurately centered or aligned. The tooth-rest is mounted on the cutter-head, as shown.

The set-up shown in Fig. 25 for grinding a staggered-tooth cutter with a straight wheel is subject to the same requirements as the one using a cup-wheel, shown in Fig. 24, with respect to the shape of the tooth-rest and the grinding edge of the wheel.

Fig. 26 shows a typical set-up for grinding the primary or secondary clearance angles on the side teeth of staggered-tooth side-milling cutters.

Sharpening Formed Milling Cutters

Unlike plain and helical-tooth milling cutters and end-mills, formed cutters are sharpened on the tooth face, as shown in Figs. 27 and 28, instead of on their peripheries, since their peripheral shape or profile must not be changed. A set-up employing an attachment for sharpening formed cutters with a dish-shaped wheel is shown in Fig. 27. One of the chief advantages of this attachment is that it positions or locates

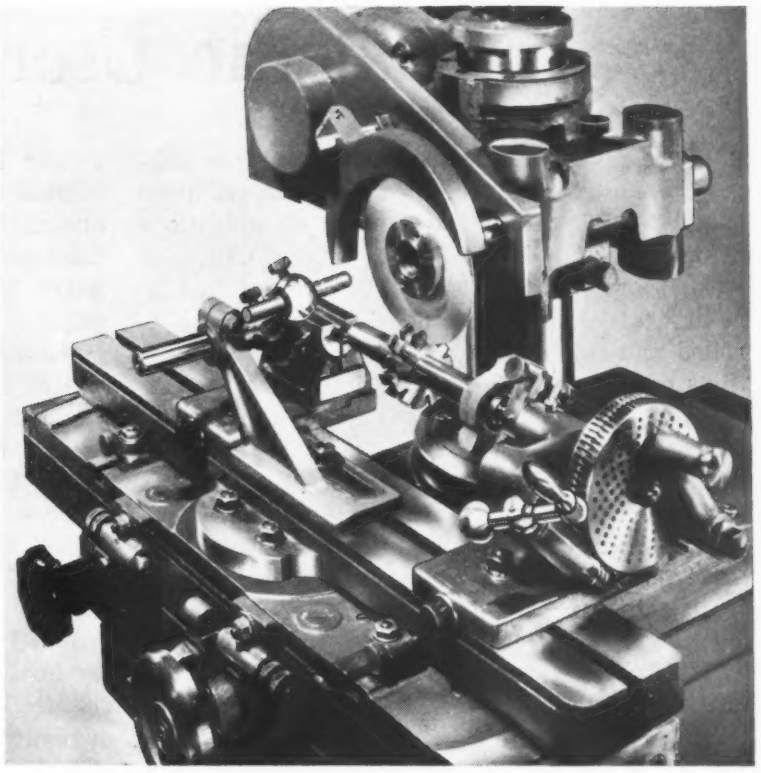


Fig. 28. Indexing Equipment Set up on a Brown & Sharpe Cutter-grinding Machine for Sharpening a Formed Cutter by Grinding the Tooth Face with a Dish Wheel

each tooth from the relieved formed periphery at a point close to the cutting edge. This arrangement results in sharpening all teeth to a uniform length, so that each tooth will remove the same amount of metal. The set-up also provides for continuous, accurate truing of the dish wheel, the truing action taking place, whenever the wheel is fed forward.

A set-up employing indexing equipment for grinding the tooth faces of formed milling cutters with a dish wheel is shown in Fig. 28. For this set-up, the truing diamond is set to dress the dish wheel in the same manner as shown in Fig. 27. This method does not provide for grinding each tooth to the same height if there is a lack of uniformity in the backed-off formed portions of the teeth, but it is, nevertheless, extensively used for grinding formed milling cutters.

Drilling Aluminum Alloys with High-Speed Steel Drills

FOR drilling aluminum alloys, the Reynolds Metals Co., Louisville, Ky., recommends that high-speed steel drills be used. In some cases, high-carbon steel drills may prove economical, but only for small-diameter holes. Drills suitable for aluminum alloys range from straight two-flute (not spiral) drills for lathe or screw machine work, where the part is rotated, to fast working 40- to 48-degree spiral drills for producing deep holes on drill presses. As a general rule, for the latter type of drilling, the spiral angle of the drill should be increased from a 24-degree spiral for very shallow holes in thin stock to the 40- to 48-degree spiral angle mentioned for deep holes.

The standard type twist drill having a 28-degree spiral angle is suitable for holes ranging from those of medium depth up to holes deeper than six times the drill diameter, while the slower action spiral of 24 degrees or less is recommended for thin stock, since it has less tendency to over-feed itself.

The point angle of 116 to 118 degrees commonly supplied on standard twist drills should be increased to about 130 to 140 degrees in order to facilitate chip removal and minimize burring. However, drills for high-silicon alloys should have a less obtuse point (down to about 90 degrees) for ease of penetration. In drilling a very thin sheet, the point angle should be even more obtuse to permit the drill to cut to its full diameter before the point breaks through. The standard lip clearance of 12 to 13 degrees should be increased to about 17 degrees for heavy feeds and for use on the stiffer alloys. Insufficient lip clearance will lead to excessive breakage.

What the User Should Know

THE first installment of this article, published in February MACHINERY, page 165, discussed the general classifications of tubing and described the manufacture of welded and seamless pipe. The present installment deals with the methods of producing hot-rolled and cold-drawn steel tubing and applications of different classes of tubing.

While the basic methods of manufacturing tubing are similar to those used for making pipe, tubing must be made to closer tolerances and therefore requires further finishing. Two processes are used in most mills today to obtain these tolerances: Hot-rolling and cold-drawing, or, as they are sometimes called, hot- and cold-finishing.

"Hot-rolling" is a term frequently used to describe the piercing operation by which solid billets are made into tube rounds, as well as the further sizing operations performed while the tube round retains its original heat or is reheated for subsequent hot-working. All seamless tubing is hot-rolled; some is further finished by cold-drawing to meet closer tolerances.

Methods of Cold-Drawing Tubing

Cold-drawing is an operation by which the tube is reduced in diameter, and sometimes in wall thickness. The equipment used for this work consists of a die-block in which is mounted a die of the desired size. The die-block is rigidly connected to one end of a long frame or bench known as a "draw-bench," as indicated at the left in Fig. 1. A heavy endless chain runs the entire length of the bench, as seen at the right. Power is supplied to the sprocket, which is located opposite the die-holder, by a gear reducer. The top surface of the bench has two rails on which a dolly is free to move. The dolly has a large hook that is engaged and disengaged with the chain and a heavy set of serrated jaws that are designed to hook on the pointed end of the tube where it projects through the die-block. This draw-bench may or may not have a mandrel at the end opposed to the drive.

The tube is first pointed in a swaging machine or by a drop-hammer, depending on its size. The unpointed end is then placed over the mandrel, and the pointed end shoved through the die a sufficient distance so that it can be grabbed by the jaws on the dolly. At this stage, the hook on the dolly is engaged by the moving chain. This results in the tubing being pulled or drawn through the die, as illustrated in Fig. 2. While being drawn, the tubing is lubricated with a special dope or oil.

This operation reduces the diameter, and, in conjunction with a mandrel, controls the inside and outside diameters, as well as the wall thickness; in addition, the finish is greatly improved. Cold-drawing may be carried on over and over again until the tube diameter has been greatly reduced; for example, a 2-inch outside diameter tube can be ultimately reduced to a hypodermic needle size of 0.008 to 0.010 inch outside diameter. It is usually necessary to anneal the tubing between each pass in order to remove the cold-working stresses set up by the drawing operations.

The newest process is the "Rock Rite" (patented) method of tube reducing. A machine

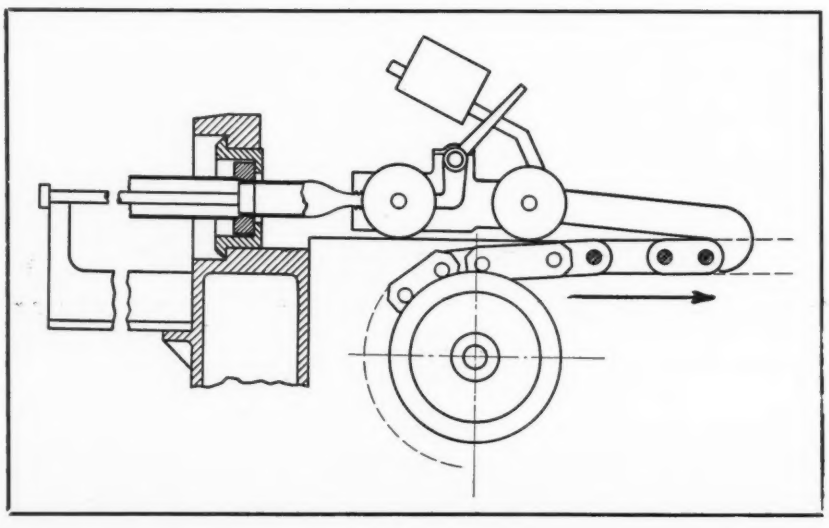


Fig. 1. Drawing a Tube in a Cold Draw-bench. Die and Mandrel are Shown at Left and Tongs and Draw Chain at Right—Sketch Courtesy National Tube Co.

About Tubing

By E. J. DeWITT
Wallace Tube Co., Chicago, Ill.

manufactured by the Tube Reducing Corporation produces a cold-finished tube of excellent quality with a greater percentage of reduction per operation than can be effected by cold-drawing. Also, the finished tube has improved workability.

The machine consists of four major components: (1) A feed mechanism that rotates the tube in a non-constant manner while feeding it ahead; (2) a tapered mandrel so designed that the large end is only slightly smaller than the inside diameter of the tube to be reduced, thus eliminating the necessity of pointing the tube; (3) a pair of semicircular dies with a groove, one end of which approximates the outside diameter of the tube to be reduced and the other end the diameter desired on the finished tube; and (4) a mechanical means of reciprocating the dies in unison with all the other components of the machine. The machine literally kneads the tube over the tapered mandrel, a little at a time, but always in a different spot, until the full length of tube has been reduced.

Tubes produced both by this process and by cold-drawing are called "cold-finished" products to distinguish them from cold-rolled tubes that are welded from a cold-rolled strip of steel. Because the "Rock Rite" process is most efficient when the cross-section of reduction is approximately 50 per cent or more, and since welded tube can be made in small sizes to fairly close tolerances, it is rarely used on welded tube.

Either welded or seamless tube is available to extremely close tolerances as a result of cold redrawing. Mechanical, alloy, and pressure tubes all go through one or more of the processes described. It is at this point in the manufacture that specific identity, apart from basic metal content, is given to the tube in question.

Characteristics and Applications of Mechanical and Pressure Tubing

Mechanical tubing is a classification that covers both carbon and alloy steel products. Pressure tubing can also be made of either carbon or alloy steel. Tolerance is the major difference between these two classifications. For example, there are ten grades of mechanical tubing, as shown in Table 1, whereas pressure tubes fall into two major classifications—average wall and minimum wall—with tolerances to suit.

Average-wall pressure tubes (Group 1) are made with a wall thickness which may vary from the nominal diameter by plus or minus 10 per cent if cold-finished, and by plus or minus 12 1/2 per cent if hot-finished. The tubes in Group 2 are made with a wall thickness that may not be less than that specified, but may be heavier by 22 to 40 per cent, depending on the type of tubing. In pressure-tube applications, the main requirement is strength, whereas dimensional accuracy is most important in mechanical tubes.

Broadly speaking, mechanical tubing is better suited for those tasks that require good machining qualities, close tolerances on diameters and wall thicknesses, strength, an excellent finish, straightness, ready availability from stock, and a satisfactory range of alloys to choose from. However, it should not be used for jobs that require short-radius bends or flares necessitating 20 per cent or more elongation nor for flanging or expanding. Pressure tubes, when available from warehouse stock, are annealed and therefore easier to work on applications such as mentioned. Mechanical tubing, as normally stocked by warehouses, is in a finished annealed state, and therefore more difficult to work.

Mechanical tubing is often used for hydraulic

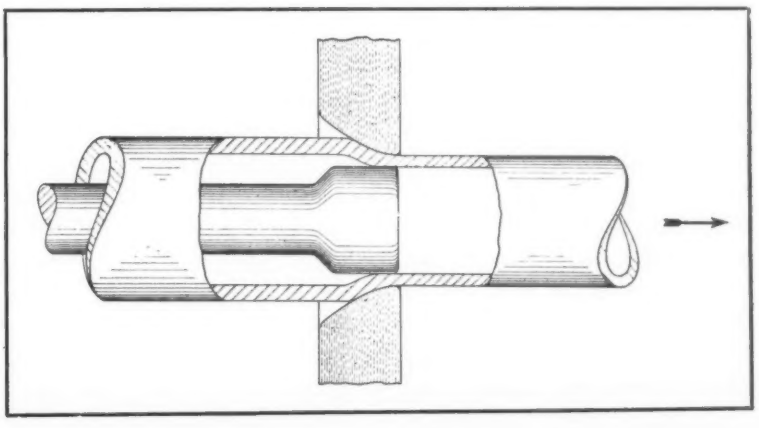


Fig. 2. Action during the Cold-drawing Operation. While being Drawn, the Tubing is Lubricated with a Special Dope or Oil

Table 1. Permissible Variations in Diameter and Wall Thickness of Cold-Drawn Mechanical Tubing

Group	Size, Outside Diameter, Inches	Permissible Variations in Outside Diameter, Inch		Permissible Variations in Inside Diameter, Inch		Permissible Variations in Wall Thickness, Per Cent	
		Over	Under	Over	Under	Over	Under
1	3/16 up to ½	0.004	0	*†	*†	*†	*†
2	½ up to 1½	0.005‡	0‡	0*†	0.005*†	10*†	10*†
3	1½ up to 3½	0.010‡	0‡	0*	0.010*	10*	10*
4	3½ up to 5½	0.015	0‡	0.005*	0.015*	10*	10*
5	5½ up to 8 when wall is less than 5 per cent of outside diameter	0.030‡	0.030‡	0.035‡	0.035‡	10	10
6	5½ up to 8 when wall is from 5 per cent to 7.5 per cent of outside diameter	0.020	0.020	0.025	0.025	10	10
7	5½ up to 8 when wall is over 7.5 per cent of outside diameter	0.030	0	0.015*	0.030*	10*	10*
8	8 to 10¾ inc., when wall is less than 5 per cent of outside diameter	0.045‡	0.045‡	0.050‡	0.050‡	10	10
9	8 to 10¾ inc., when wall is from 5 per cent to 7.5 per cent of outside diameter	0.035	0.035	0.040	0.040	10	10
10	8 to 10¾ inc. when wall is over 7.5 per cent of outside diameter	0.045	0	0.015*	0.040*	10*	10*

*For tubes with inside diameter less than 50 per cent of outside diameter, with wall thickness more than 25 per cent of outside diameter or with wall thickness over 1¼ inches, or weighing more than 90 pounds per foot, which cannot be successfully drawn over a mandrel, the inside diameter may vary over or under by an amount equal to 10 per cent of the wall thickness. The wall thickness may vary 12½ per cent over or under that specified.

†For tubes with inside diameter less than ½ inch (or less than 5/8 inch when the wall thickness is more than 20 per cent of the outside diameter), which cannot be successfully drawn over a mandrel, the wall thickness may vary 15 per cent over or under that specified and the inside diameter will be governed by the outside diameter and wall thickness variations.

‡Tubing having a wall thickness less than 3 per cent of the outside diameter cannot be straightened properly without a certain amount of distortion. Consequently such tubes, while having an average outside diameter and inside diameter within the tolerances shown in the table, will require an ovality tolerance of ½ per cent over or under the nominal outside diameter and inside diameter, this being in addition to the tolerances indicated in the table.

Courtesy of National Tube Co.

pressure lines in circuits. However, it is not pressure tested, and is harder than needed for this kind of work. If the frequency and character of shock in the system are severe, the strains from cold-drawing may cause trouble. It is preferable to use pressure tubes for such applications. There are pressure tubes designed especially for just that kind of work.

Frequently, hydraulic cylinders are made from mechanical tubing. If the pressures are not too high (approximately 1500 pounds per square inch or under) and the wall thickness is adequate, the closer finish sizes of mechanical tubes may offset the lack of test assurance. If, however, the pressures are as high as 2000 pounds per square inch and over, it should be known, before investing labor and money in a cylinder made from mechanical tubing, that the mill has tested the tubing at pressures exceeding those that it must withstand. As most cylinder tubes have to be machined in any event, it would be well to try seamless pipe. Such pipe is substantially cheaper, and has been tested, in some sizes, up to 2500 pounds per square inch.

Stainless-steel tubing can be either of the mechanical or pressure type, but an endless variety of different alloys is available. As a result, the metallurgy of stainless steels can be very confusing. However, as a general rule, these steels can be divided into three groups: The steels in Group A include AISI Nos. 403, 410, 414, 416 and 420; those in Group B, AISI Nos. 329, 406, 430, and 442; and those in Group C, AISI Nos. 302, 303, 304, and 316. There are special variations of the C group designated as the CX steels; this group had a widespread utilization during the war for high-temperature exhaust applications on planes. The CX steels are obtained by the addition of columbium or titanium to low-carbon steel 304.

Groups A and B can best be distinguished as being magnetic stainless steels, while Group C steels are non-magnetic due to their austenitic structure. Another way of differentiating between the groups is by their response to heat-treatment. Group A steels respond to hardening and tempering in the same way as ordinary carbon steels. Group B steels are more difficult to harden and those in Group C do not respond to hardening by heat-treatment in any form.

Still another distinguishing property of the different groups is toughness. Unless hardened, Group A stainless steels are not brittle. Group B steels have a lower impact resistance in notched sections, and those in Group C are extremely tough. Group A steels can be cold-drawn, rolled,

Table 2. Commercial Classifications of Pipe

Type	Welded or Seamless	Per Cent Carbon	Special Alloy, Per Cent	Size, Inches	Specification
Black and Galvanized Pipe	Either (Usually Welded)	Usually 0.15	None	1/8 to 12 Nominal	ASTM A-120
Standard Pipe for Coiling, Bending, and Special Purposes	Either (Usually Welded)	Usually 0.15	None	1/8 to 12 Nominal	ASTM A-53
Steel Pipe for High-Temperature Service	Either	Up to 0.35	0.3 to 0.6 or 1.0 Mn, limited Si, P and S	1/8 Nominal to 24	ASTM A-106
Electric-Resistance Welded Steel Pipe	Welded	Usually 0.15	None	1/8 Nominal to 30	ASTM A-135
Electric-Fusion Welded Steel Pipe	Welded	Usually 0.15	None	8 Nominal up to 30	ASTM A-139
Alloy-Steel Pipe for High-Temperature Service	Seamless	0.08 to 0.15	Various	1/8 Nominal to 24	ASTM A-158
Carbon-Molybdenum Alloy-Steel Pipe for High-Temperature Service	Seamless	0.10 to 0.20	0.45 to 0.65 Mo, 0.3 to 0.6 Mn	1/8 Nominal to 24	ASTM A-206
Casing Pipe	Either	—	—	4 1/2 to 20 O.D.	API 5A
Drill Pipe	Either	—	—	2 to 6 Nominal	API 5A
Pump Pipe	Either (Usually Galvanized Seamless)	—	—	1 and 1 1/4 Nominal	—
Water-Well Reamed and Drifted Pipe	Either	—	—	1 to 12 Nominal	—
Ammonia Pipe	Either (Usually Welded)	Usually 0.10	None	3/4 to 2 Nominal	ASTM A-53 or A-135
Bedstead Tubing	Either (Usually Welded)	Usually 0.10	None	—	—
Conduit Pipe	Either (Usually Welded)	Usually 0.10	None	1/8 to 6 Nominal	—
Conduit Tubing EMT	Either (Usually Welded)	Usually 0.10	None	1/4 to 2 Nominal	—
Dry Kiln Pipe	Either (Usually Welded)	Usually 0.10	None	3/4 to 1 1/4 Nominal	—
English Gas and Steam Pipe	Either (Usually Welded)	Usually 0.10	None	1/8 to 6 Nominal	AISI-TP901
Ice Machine Pipe	Either (Usually Welded)	Usually 0.10	None	3/4 to 2 Nominal	ASTM A-53 or A-135
Line Pipe	Either (Usually Welded)	Usually 0.10	None	1/8 Nominal to 24	API 5-L
Mechanical Service Pipe	Either (Usually Welded)	Usually 0.10	None	1/8 to 12 Nominal	—
Nipple Pipe	Either (Usually Welded)	Usually 0.10	None	1/8 to 12 Nominal	—
Pipe for Plating and Enameling	Either (Usually Welded)	Usually 0.10	None	—	—
Pipe for Piling	Either (Usually Welded)	Usually 0.10	None	8 5/8 to 24 Outside Diam.	ASTM A-252
Pressure Piping	Either (Usually Welded)	Up to 0.35	Various	1/3 Nominal to 24	ASTM A-106 ASTM A-135 ASTM A-158 ASTM A-206 API 5-L
Signal Pipe	Welded	—	—	3/4 and 1 Nominal	AAR-M122
Water-Main Pipe	Either	—	—	1 1/2 Nominal to 96	ASTM A-53 ASTM A-120 ASTM A-134 ASTM A-135 ASTM A-139 ASTM A-211 API 5-L AWWA 7A3 and 7A4 Underwriters Labs. Std. SPI 888
Drive Pipe	Either	—	—	6 Nominal to 16	—
Driven Well Pipe	Either (Usually Galvanized Seamless)	—	—	1 to 2 Nominal	—

bent, formed, coined, and deep-drawn. The same is generally true of Group B steels. The steels in Group C work-harden. They can have all the things done to them that are done to Groups A and B, but if the operations are severe, it may be necessary to anneal them between operations. All these steels are corrosion-resistant, the degree depending on the application. The best for extreme conditions are the Group C steels.

Recapitulating, there are three major divisions of tubular products. The broadest division, from a use viewpoint, is pipe, followed by mechanical tubing and pressure tubing. At present, mechanical tubing can be most easily obtained, while the supply of pressure tubing and pipe is more restricted. The prices of the common forms of these classifications are in the same order—mechanical tubing being the highest, and pipe being the lowest.

As has been pointed out, the principal difference between pipe and tubing is in dimensional tolerances. Many times it is possible to use pipe in cases where tubing formerly was applied, with a substantial cost saving. Table 2 gives a list of the kinds of pipe that are normally available and the size ranges in which they are made.

Westinghouse Machine Tool Electrification Forum

THE 1948 Westinghouse Machine Tool Electrification Forum will be held in Buffalo, N. Y., on April 22 and 23. The first day's session will convene in the Niagara Room of the Hotel Statler, and the second day's session will take place in the auditorium of the Westinghouse Buffalo plant.

The keynote of this year's forum will be "control." Kermit Kuck, of the Monarch Machine Tool Co., Sidney, Ohio, will open the discussion with a paper "Electronic Lathe Controls." He will be followed by R. J. Teetsell, instrument specialist, Westinghouse Electric Corporation, Pittsburgh, Pa., who will discuss "Application of Instruments to Machine Tools." E. P. Bullard III, Bullard Co., Bridgeport, Conn., will conclude the morning session with a paper entitled "A Recent Development in Automatic Lathe Control."

J. J. Jaeger of Pratt & Whitney Division, Hartford, Conn., will start the afternoon session with a paper "Control Problems in Keller Machine." This will be followed by a paper "Oscillographic Performance Analysis of Automatic Tool Sharpener," by Royce Johnson, of the Barber-Colman Co., Rockford, Ill. Myron S. Curtis, of the Warner & Swasey Co., Cleveland, Ohio, will then discuss "Turning Points in the Metal-Working Industry." The first day's session will conclude with a report of the National Machine Tool Builders' Association's Electrical Committee. W. B. Wigdon, electrical engineer, Cincinnati Planer Co., Cincinnati, Ohio, is chairman of this committee and will act as chairman of this part of the program.

Inasmuch as the Control Division of the Westinghouse Electric Corporation is in the process of moving from East Pittsburgh, Pa., to Buffalo, G. H. Welch, manager of this division, will open the discussion on the second day with a resumé of control production facilities and plans for the future. G. A. Caldwell, manager of engineering, Westinghouse Control Division, will then present a paper "Electronic Motor Control," accompanied by an actual demonstration. The final paper in the morning session will be one by L. W. Herchenroeder, engineer with the Westinghouse Industry Engineering Department, entitled "Selecting Direct-Current Power Sources for Machine Tools."

The afternoon session will commence with a tour through the Westinghouse plant. Tell Berna, general manager of the National Machine Tool Builders' Association, will bring the formal discussion portion of the forum to a close with a report on the machine tool industry.

* * *

New Alloy Improves Machinability of Gray Iron

The relative ease with which a metal can be machined to final shape is an important factor in its ultimate usefulness to industry. To improve the machinability of gray iron, the International Nickel Co., of New York City, has developed an inoculating alloy called "Nisoloy." The composition of this alloy is approximately 60 per cent nickel, 30 per cent silicon, and 10 per cent iron. Since the nickel-silicon contents are in the eutectoid proportion, the melting point of the alloy is much lower than that of either nickel or silicon, and is also lower than that of cast iron. Owing to this and to its relatively high specific gravity, the alloy penetrates and diffuses rapidly through the melted metal and exerts a homogenizing influence upon the product.

Changes in MACHINERY'S Advertising Sales Staff

Edward K. Hammond, Who has been Connected with MACHINERY for over Thirty-five Years and Who Retired April 1

Boyce M. Tope, Who has been Made Advertising Representative for MACHINERY in Western Ohio, Indiana, and Michigan

George H. Buehler, Advertising Representative of MACHINERY for All States West of Indiana to Colorado

EDWARD K. HAMMOND, who has been connected with MACHINERY'S organization for over thirty-five years, retired on April 1. Mr. Hammond became an associate editor of MACHINERY in September, 1912, and held that position until July, 1921, when he was made central western manager of advertising sales, with headquarters in Cleveland. In July, 1923, he was appointed western manager of advertising sales, with headquarters in Chicago, serving in that capacity up to the date of his retirement.

At the recent annual stockholders' meeting of THE INDUSTRIAL PRESS, the following resolution was passed: "The officers and directors of THE INDUSTRIAL PRESS wish to take this opportunity to express to Edward K. Hammond, who has asked to be retired from active duty effective April 1, 1948, their appreciation for his many years of service, first on MACHINERY'S editorial staff and later as western advertising manager. In the thirty-five years he has been with THE INDUSTRIAL PRESS, Mr. Hammond has worked hard and effectively, contributing largely to the upbuilding of MACHINERY'S prestige, as well as to the growth of advertising volume in the territory covered. His friends and associates in THE INDUSTRIAL PRESS hope that although no longer actively connected with this organization, he will nevertheless feel that he will continue to be considered a member of THE INDUSTRIAL PRESS family."

Boyce M. Tope, who has been MACHINERY'S advertising representative for the state of Michigan, now becomes district manager of a territory that includes western Ohio, Indiana, and Michigan.

George H. Buehler, who has been representative in the middle-western territory, has been made Chicago district manager. His territory includes all states west of Indiana to Colorado.

* * *

Abrasive-Belt Moving Picture

Many of the sequences of a new motion picture entitled "A Machine of the Age," which features machining by the application of abrasive belts, were filmed under actual working conditions in different shops. The film demonstrates the high production rates possible in surfacing, stock removal, and grinding operations on metals, glass, plastics, wood, and other materials. The technique is traced from the earliest dry-belt methods up to present-day machines which utilize cloth-backed abrasive belts for use with soluble oils. This motion picture is obtainable from the Porter-Cable Machine Co., 1714 N. Salina St., Syracuse 8, N. Y.

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Low-Carbon 8½ Per Cent Nickel Steel for Sub-Zero Applications

The increasing use of sub-zero temperatures in many industries, such as for certain operations in the petroleum refining and chemical process fields, and the advantages of storing gases in the liquefied state have stimulated interest in the development of moderately priced materials which are resistant to brittle behavior at low temperatures and can be readily fabricated by the usual methods, including welding. These needs resulted in the development of a low-carbon steel containing 8 to 9 per cent nickel by the International Nickel Co., 67 Wall St., New York 5, N. Y.

While the primary purpose of the research leading to its development was for low-temperature service, it is already being adopted for other fields, where low temperatures are not involved. Among the prospective applications are oil-well tubing for deep wells, seamless tubes for black liquor evaporators, forging hammer rods, and solder rolls. 201

New All-Purpose Base for Cutting Compounds

A base for cutting compounds known as "Antisep All-purpose" base, which is high in both sulphur and saponifiable content and can be diluted with either oil or water, has been recently announced by E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia, Pa. It can be used as a soluble oil on the most difficult machining operations, and its chemical properties are not changed even when it is diluted with a high percentage of water.

In extensive tests, the new base has proved to have rapid cooling qualities, allowing high machine feeds and speeds, giving better finish, cool work, and longer tool life, and eliminating "blue" rejections. It has shown satisfactory lubricating properties, even when mixed with water, to protect bearings and spindles of automatics, and also possesses rust-preventive properties, preventing corrosion, staining, or pitting of parts. In addition, its applicability to more than 90 per cent of metal cutting and forming operations, including general machining, stamping, and drawing, makes possible the use of a single, concentrated product, so that inventory, storage, and handling costs are appreciably reduced..202

Sulphuric-Acid Resistant Steel Available in Wrought Forms

The development of new manufacturing methods has made possible the production of a sulphuric-acid resistant stainless steel in the form of bar stock, wire, strip, tubing, and pipe. Until the present time, this stainless steel has been available only in cast form, known as Durimet 20, manufactured by the Duriron Co., Inc., Dayton, Ohio.

Development of the new processes for manufacturing the material in its present forms has been announced by the Carpenter Steel Co., Reading, Pa. Through an exclusive licensing arrangement with the Duriron Co., the alloy will be manufactured in its new wrought forms by the Carpenter Steel Co. under the name "Carpenter Stainless No. 20."

Because of its excellent resistance to the corrosive effects of sulphuric acid, as well as many other substances, Carpenter Stainless No. 20 can be used extensively in the manufacture of heavy chemicals, organic chemicals, synthetic rubber, high-octane gasoline, solvents, explosives, plastics, and pharmaceuticals. In addition to superior corrosion resistance, it retains the good mechanical properties of 18-8 stainless steels. Typical uses include pump shafts and rods, valve stems, tie-rods, pipe lines, fittings, screens, etc.

The analysis of the new alloy is as follows: Carbon, 0.07 per cent maximum; manganese, 0.75 per cent; silicon, 1 per cent; chromium, 20 per cent; nickel, 29 per cent; molybdenum, 2 per cent minimum; and copper, 3 per cent minimum. 203

"Tailor-Made" Plastics Introduced by Pittsburgh Plate Glass Co.

Selectron resins—highly versatile plastics developed by the Pittsburgh Plate Glass Co., 632 Duquesne Way, Pittsburgh, Pa., for wartime radar and aircraft applications—are now being made available for a wide range of peacetime uses. Each of the Selectron series of resins has been designed to suit a specific application or type of application in industry. Variations of viscosity, adhesive quality, and curing conditions are all taken into consideration. Within limits, the resins are being made to specifications individually designed to meet the customer's particular requirements.

Applications of the Selectron series of resins include laminating, impregnating, casting, molding, and use as adhesives. 204

Precision Plaster Castings Made of High-Conductivity Copper

A new technique in plaster mold casting permits the making of precision copper castings with up to 95 per cent conductivity. The new method, announced by Universal Castings Corporation, 5821 W. 66th St., Chicago 38, Ill., produces a non-porous casting with a smooth finished surface. Accurate detail of the most intricate parts, weighing from a fraction of an ounce to several pounds, is assured by this process. These copper castings are expected to find application in electrical and electronic instruments and in machines where the high-conductivity feature can be utilized to advantage...205

Synthetic Wax Used as Lubricant in Drawing High-Carbon Steels

Pilot-plant and production-scale tests with a new synthetic wax manufactured by the Glyco Products Co., Inc., Brooklyn 2, N. Y., used as a lubricant in "dry drawing" high-carbon steels have shown highly satisfactory results. This wax, known as "Acrawax C," alone or in conjunction with other common ingredients, markedly reduces friction and heat, decreasing scratching and wire breakage. Considerable increase in drawing speeds, longer die life, and improved surface of the steel are results reported from its use.

This wholly organic synthetic wax is a heat-stable material with a high melting point of from 284 to 288 degrees F. The high melting point, together with a lower coefficient of friction and higher specific heat than soap, makes possible "coolant" action and superior lubrication over a higher temperature range.

The compound is being used successfully in "dry drawing" high-carbon steel wire rope, spring wire, and tire bead wire. It is also being adopted as a lubricant for drawing bars and rods, as well as odd and round shapes, of high-carbon and alloy steels. 206

Phenolic Molding Powder Line Announced by General Electric

The General Electric Chemical Department, Pittsfield, Mass., is now marketing a complete line of phenolic molding powders designed to satisfy the majority of the needs of the average molder. The new line includes general-purpose, high heat-resistant, and impact-resistant plastic materials.

The quality and uniformity of the molding powders are maintained by a series of critical tests, which are made on every batch of material prior to shipment. These tests measure such properties as specific gravity, tensile strength, dielectric strength, flow, powder pourability, shrinkage, and Izod impact strength. 207

High-Temperature Ceramic Coatings for Steel

As a result of wartime research, a new type of ceramic coating for the high-temperature protection of mild steels has been developed by the National Bureau of Standards. Coatings of this type have been shown by laboratory and service tests to be superior to conventional enamels for high-temperature service, and they have important peacetime applications.

The new coatings embody several outstanding features including high resistance to chipping under repeated severe thermal shock; protection of the metal against oxidation during prolonged exposure in air at temperatures up to about 1250 degrees F.; freedom from cracking and blistering produced in conventional porcelain enamels under comparable conditions of high temperatures and severe thermal gradients; and a matte surface that does not show highlights, and therefore decreases the visibility.

Some industrial applications for these coatings are baffle plates of continuous furnaces; parts for heat interchangers for marine and other turbine engines; annealing boxes; and the exteriors of large tanks that are coated internally after sand-blasting with the conventional type of enamel. 208

Liquid Tripoli Composition Available in Four Grades

The Hanson-Van Winkle-Munning Co., Matawan, N. J., has announced four grades of a new liquid tripoli composition—Acme Nos. 2-L-70, 2-L-75, 2-L-77, and 2-L-79. The characteristics of these polishing compositions are: No. 2-L-70, double duty with superior color; No. 2-L-75, medium cut with good color; No. 2-L-77, good cutting with medium color; and No. 2-L-79, heavy cut with medium color.

Acme liquid tripoli can be used with any type of spray equipment. The pressure method of feeding liquid tripoli to the wheel is preferred over the gravity feed. When liquid compositions can be applied, the advantages over the bar type are large savings in amount of composition used; considerable savings in buffs; higher color per degree of cut; and ease of application. 209

Low Silver Content Solder for Brazing with Exceptional Tensile Strength

A new silver solder that has the advantages of high capillary action, exceptional tensile strength, and good appearance after brazing is being produced by the All-State Welding Alloys Co., Inc., 96 W. Post Road, White Plains, N. Y. This solder, known as All-State No. 20, is particularly economical, since its silver content is 20 per cent—a proportion that has been found to give higher tensile strength than solders with a greater content of silver. It has a melting temperature of 1430 degrees F. and a shearing strength of 145,000 pounds per square inch.

The new solder is particularly suitable for the brazing of carbide tips to steel shanks and for the fabrication of light steel parts. It is also recommended for use on steel, brass, copper, stainless steel, and Inconel. 210

Glass Fabric Utilized for Hot-Material Conveyor Belt

Development of a hot-material conveyor belt using glass fabric instead of the cotton fabric employed in the conventional belt made for this service has been announced by the B. F. Goodrich Co., Akron, Ohio. Two weights—four-ply for light service and five-ply for wider, longer belts where working stresses will be somewhat higher than in the light service—are being made available.

The tensile strength of each ply of glass fabric is said to be approximately equal to the standard 32-ounce cotton fabric used in conventional belts. It is claimed that the advantage of glass fabric for this service is its resistance to loss of strength under high temperatures. 211

Wooden-Pattern Lacquer with Improved Properties

A pattern lacquer for use by the foundry industry has been developed by the Glidden Co., Cleveland, Ohio. The new product is used for the preservation and identification of wooden patterns, and provides a smooth surface to which foundry molding or core sand will not adhere. The lacquer offers excellent resistance to water, oil, kerosene, heat, and abrasion, and does not become brittle with age or use. It permits easy and smooth release from hot molding or core sand and reduces the need for patching. ...212

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on these pages, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in April, 1948, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on the blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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[This service is for those in charge of shop and engineering work in manufacturing plants.]

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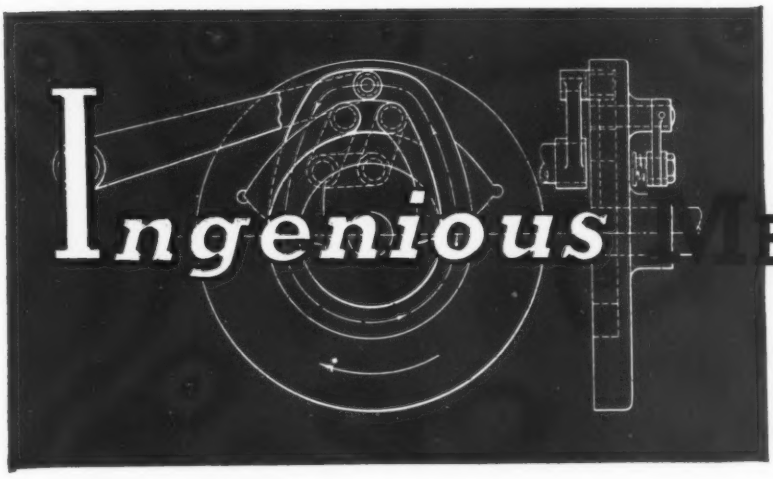


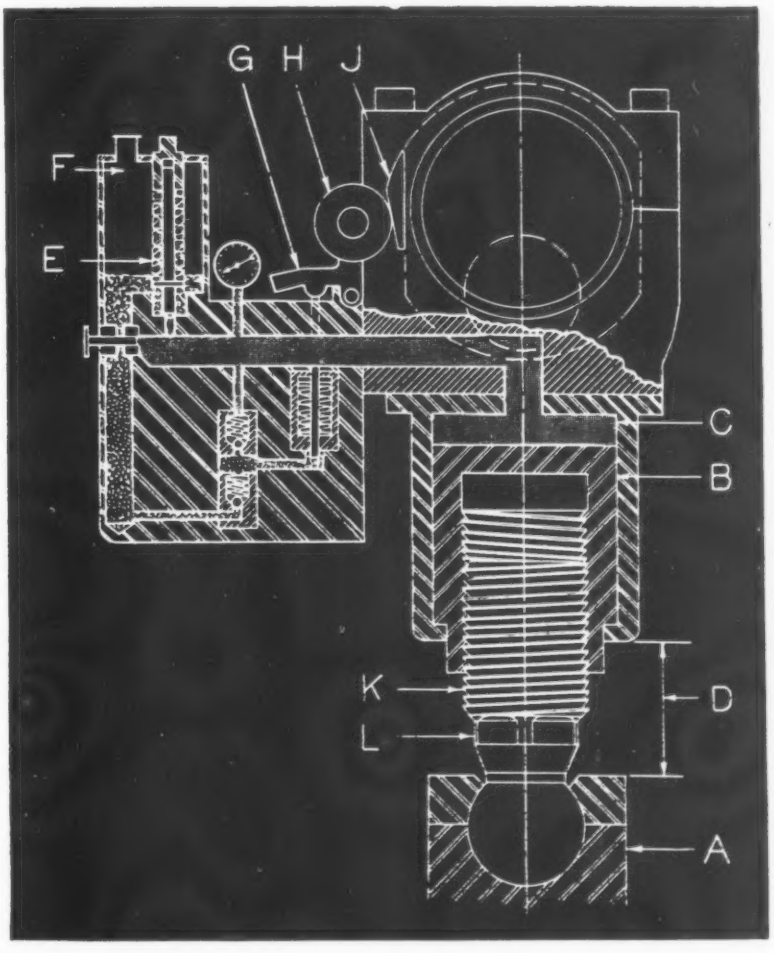
Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Hydraulic Mechanism for Preventing Overload of Punch Presses

The mechanism shown diagrammatically in the accompanying illustration is designed to prevent the crank or frame of a punch press from being damaged through overloading. It is incorporated in six sizes of pitmans made by the Dayton Rogers Mfg. Co. to replace the original pitmans of presses having capacities ranging from 37 to 350 tons. The pitman has a standard adjusting screw and a ball-socket connection to fit any press ram. A link for pin connection to the ram can be provided when necessary.

A calibrated hydraulic relief valve can be set for any desired working tonnage to protect the press or the dies used on the press. With this overload protecting device, constant ram pressure is assured at the operating point, regardless of stock thickness variations, on such operations as forming, pressing, riveting, briquetting, or assembling. In case the preset working pressure of the press ram *A* is exceeded during the working cycle, the piston *B* will re-



Hydraulically Controlled Mechanism of Punch-press Pitman Designed to Prevent Overloading the Punch-press Crank and Frame or the Press Dies

treat against the high-pressure oil chamber *C*, allowing the overload linkage to shorten the distance *D*.

The oil escapes through the overload valve *E* to the reservoir *F*. Resetting and re-establishing of the high pressure in chamber *C* are accomplished by means of the hand pump *G*. The roller *H* is actuated by the press cam *J*, maintaining a constant preset pressure in the chamber *C* at all times. The die set-up is accomplished in the usual manner through the pitman adjusting screw *K*.

Mechanism Designed for Quick Stopping and Easy Removal of Bobbin Spindle

By HAROLD E. MURPHEY

The driving and supporting mechanism of a thread bobbin spindle for a textile machine is shown in the accompanying illustration. This mechanism has been designed to permit quick starting and stopping of the spindle *D* and to provide for easy removal of the spindle from its supporting bracket.

The bracket stand *E* is fastened to the rail of the machine, and is kept in place by spring *F*, which is held under compression by a hexagonal nut and washer. This construction serves to retain the bracket in its operating position and yet permits it to be easily adjusted or swung about the axis of the locating stud at its base. The bracket *A* swings on stud *L*, which is held in stand *E* by a screw as shown. Bracket *A* is bored out to receive the sealed type ball-race bearing for the lower end of spindle *D*. This ball race is a push fit in the bracket and a drive fit on the end of the spindle.

The belt guard *B* is also bored out at the top, as shown, for a ball race. This ball race is a push fit in the guard and a drive fit on the spindle. The belt guard is cut out on one side, as shown in the top view, to permit the belt to make contact with the whorl *C*. It also has a cut-out place on the opposite side to provide clearance for the brake lever to pass through when the bracket is swung away from the belt to bring the whorl into the position indicated at *M*.

The whorl *C* is a drive fit on the spindle *D*. The belt guard *B* is held to the stand *E* by two fillister-head screws *N*, fitted in bayonet type locking slots. If, for any reason, the spindle has to be removed, a twist of the guard brings the heads of screws *N* into line with the large holes *O* in the guard, so that the spindle and whorl can be easily removed.

The illustration shows the swinging bracket *A* in the forward position with the whorl against the driving belt. When the whorl is to be stopped for removing the bobbin, bracket *A* is pulled away from the belt until pawl *I* drops into the recess *R* in the bracket. As pawl *I* drops into the recess, the whorl makes contact with the brake, and is thus stopped. The full bobbin can then be removed and an empty one can be placed on the spindle. Simply releasing pawl *I* permits the tension spring *G* to return the bracket to the driving position, with the whorl against the belt.

It will be noted that the guard *B* has a machined recess at *S* which fits over a machined hub on the bracket *A*. The tolerance on these two mating members should be close. The recess for the ball races in these members should also be machined to very close tolerances.

* * *

Expanding Applications of Aluminum

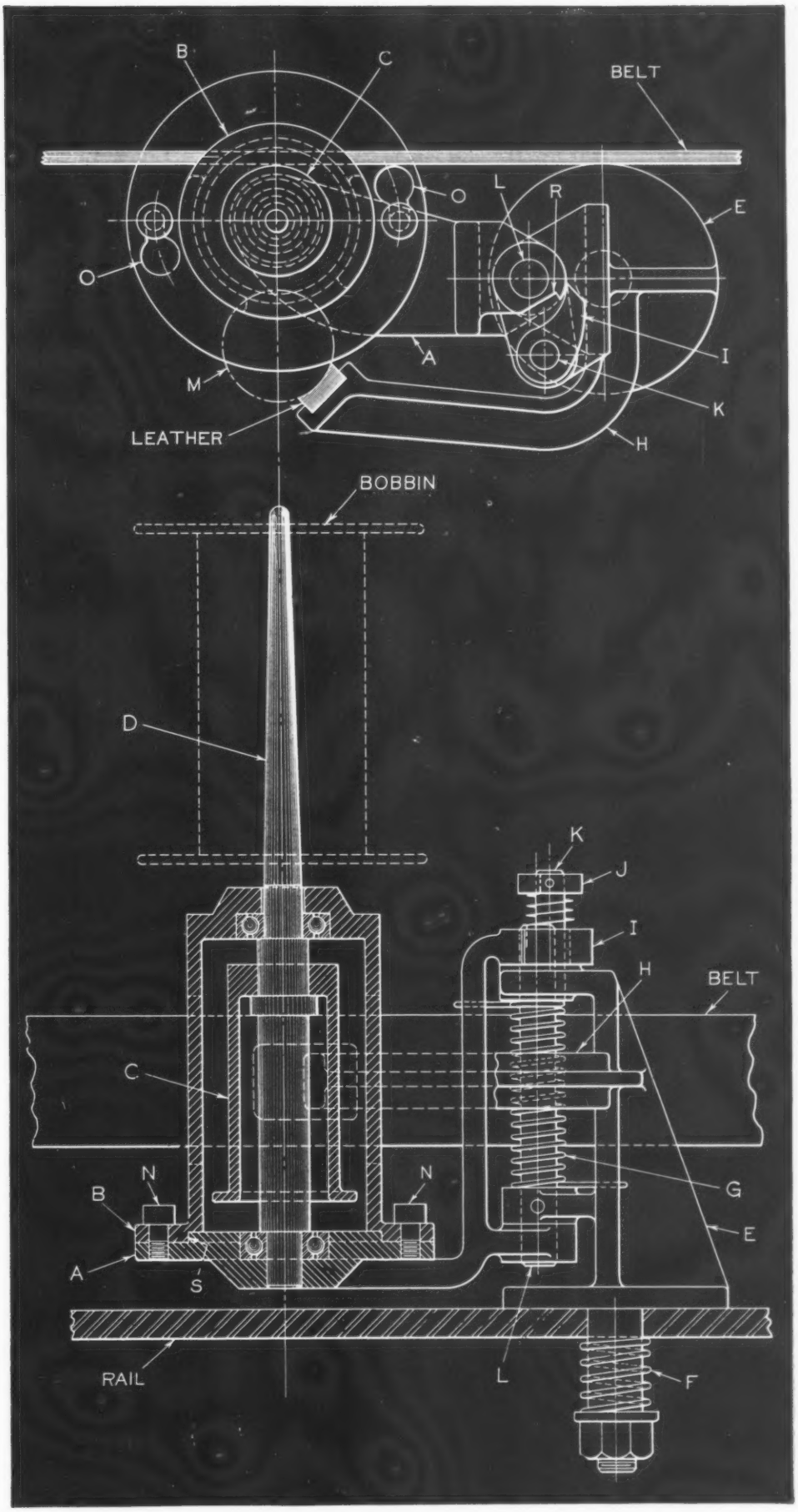
The use of aluminum for commercial vehicles and automobiles increased greatly during 1947, according to the Aluminum Co. of America. In addition to its application for body construction, bumpers, heaters, seats, window-frames, stanchions, and door fixtures on trucks, buses, and trailers, aluminum was also employed in substantial quantities for bus and truck engine parts, such as pistons, cylinder heads, and camshaft gears. The use of aluminum bearings increased in 1947, and is expected to expand in 1948, especially for application to heavy-duty engines.

There are indications too that the use of aluminum will increase greatly for automobile parts. A number of new aluminum parts have already been or are scheduled to be adopted on one or more current automobile models. Among those fabricated from sheet stock are running boards, head-lamp housings, front-fender braces, front-fender air deflectors, radiator shields, floor-board panels, air-intake pipes and ducts, heater housings, and many other parts.

Applications for aluminum extrusions may consist of seat tracks, bumpers, accelerator pedals, hood latch assemblies, etc. Potential applications for aluminum castings include clutch housings and torque converter parts.

* * *

If all the coal used in the giant Rouge plant of the Ford Motor Co. arrived by rail, it would require a train of 300 cars each day to maintain the average inventory.



Mechanism that Permits Quick Stopping and Easy Removal of Bobbin Spindle

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Pitting of Casehardened Gears

A. C. K.—Recently we have been receiving complaints from several of our customers that the gears we are supplying are pitting. These gears are used in gear reducers and various machine tools, and preliminary examination of service conditions indicates that the gears are correctly mounted, receive proper lubrication, and operate under the recommended loads and speeds. We caseharden the tooth surfaces of these gears, which are made of Nitralloy G, in a nitriding furnace to a depth of about 0.025 inch (fifty-hour cycle) and check for hardness, accuracy of profile, run-out, etc., before shipment. Many of these gears formerly were carburized and did not give any trouble. Have you heard of any similar difficulty experienced by other companies?

A.—You indicate that you have gone into nitriding on a bigger scale than previously, and you may be experiencing difficulty in securing the correct furnace conditions. One result of improper furnace control may be an excess amount of white nitride on the tooth surfaces. This is a thin layer composed of white nitrides of iron that is hard but brittle, and is easily chipped, particularly when the gears are subjected to shock loading. It can be seen under the microscope, and should not measure more than 0.001 inch thick. The furnace cycle employed by the Wright Aeronautical Corporation to hold the white nitride layer to 0.0005 inch or less is described in June, 1947, MACHINERY, page 172.

When Machinery is Sold "As Is," Does the Buyer Have No Recourse?

P. F.—When we sign a contract to buy machinery that contains an "as is" clause, does this mean that we have no recourse against the seller?

Answered by Leo T. Parker, Attorney at Law
Cincinnati, Ohio

Recent higher court decisions consistently hold that if equipment sold is found to be useless, the seller has not complied with his implied warranty unless the testimony proves conclusively that the purchaser realized that such equipment was useless before he bought it. This is so because there is an implied warranty in every sale unless the contract clearly provides otherwise. Therefore, although a contract of sale clearly specifies that equipment is sold "as is," the seller still may be liable on an implied guarantee.

For illustration, in Maddox v. Katz [8 So. (2d) 749], it was shown that a seller sold equipment under a written contract of sale which contained a clause that the equipment was being sold "as is." Later the purchaser discovered that the quality of the equipment was not so good as he had believed when he made the contract of purchase. He sued the seller, and the Court held: "The clause 'as is' when employed in a contract of sale does not relieve the vendor of all warranty."

In other words, in order for a seller to be relieved of all warranty, the sale contract must contain an "as is" clause plus further statements in the written contract which prove conclusively that the purchaser knows that he is purchasing the equipment without any guarantee. A mere "as is" clause in a contract will not always convince the Court that the purchaser assumed responsibilities, particularly if the equipment has hidden or inherent defects.

Joining Alloy and Carbon Steel

D. M.—Would it be practicable to arc-weld a shaft of S A E 3140 steel to a shaft of S A E 1045 steel?

A.—While a steel of the S A E 3140 type requires special handling, it can be welded. Both steels should be preheated to approximately 500 degrees F., and after welding, the weld should be stress-relieved at a temperature of 1100 to 1150 degrees F. to prevent distortion and brittleness. Both preheating and stress-relieving may be done locally. If the S A E 3140 forging is used in the heat-treated condition, the material adjacent to the weld will have lower strength than the remaining section of the forging which has not been affected by the heat.

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Ingenious Method of Threading Both Ends of a Bar Simultaneously

By MARK W. PURSER, Tenafly, N. J.

An ingenious method is used by the Farmingdale Aircraftsmen Mfg. Corporation, Farmingdale, N. Y., for threading both ends of a piece of bar stock simultaneously. The operation is performed with two rotary die-heads on a small engine lathe, the lead-screw of the lathe being disconnected. Jones & Lamson tangent style die-heads are used. They are the type in which the "height above center" of the chaser can be controlled in the tool-grinding department, thus eliminating lathe "down time."

This set-up can be used to advantage whether the threads at each end of the work-piece are similar or not. The threads at the ends may be of different lengths, diameters, forms, pitches, and number of starts. Both threads can be right- or left-hand, or one may be right-hand and the other left-hand. Class 3 threads with a lead error not exceeding 0.001 inch per inch of thread length can easily be cut with this set-up.

The manner in which the die-heads are arranged is shown in Figs. 1 and 2. It will be seen that one head is attached to the regular headstock spindle at the left, and the other is attached to the spindle of an auxiliary headstock mounted on the right-hand end of the lathe. A separate electric motor K_1 drives the spindle of the auxiliary headstock.

The foot-actuated pulley and cable arrangement that controls the movement to right or left of the auxiliary headstock J_1 on the bed ways is shown in Fig. 3. Carriage E is free to float longitudinally between two helical springs F and F_1. These springs return the carriage to its normal or starting position at the end of an operation. The springs are attached to headstocks J and J_1. Air-actuated vise Z, with jaws especially designed to hold the work-piece firmly in place, is mounted on the cross-slide of the lathe.

When foot-pedal N_1, at the right, is depressed,

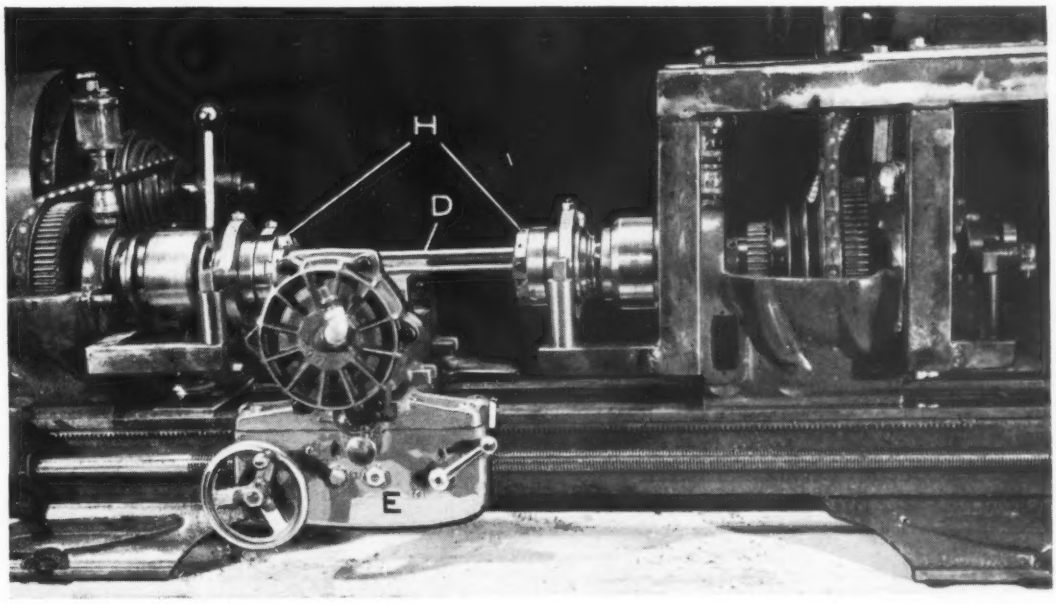


Fig. 1. Lathe Set-up for Threading Both Ends of a Bar Simultaneously. Two Die-heads H are Used, One Attached to the Regular Headstock Spindle at the Left, and the Other Held in an Auxiliary Headstock Mounted at the Right

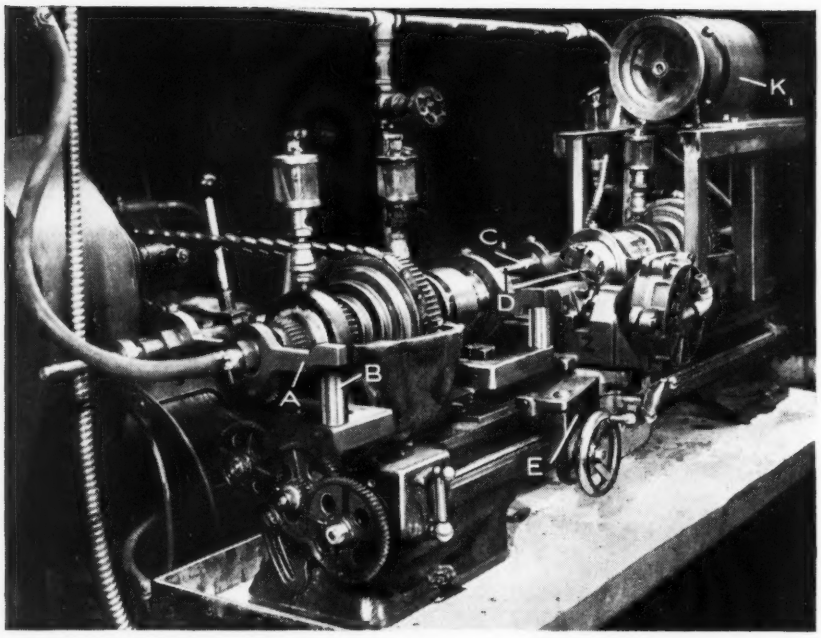


Fig. 2. View of Lathe Set-up Illustrated in Fig. 1, Showing the Tripping and Coolant System for the Die-head at the Left-hand End, Corresponding to that Shown in Fig. 4 for the Die-head at the Right-hand End of the Machine

the right-hand headstock J_1 is pulled by cable O_1 to the left. When the chasers of the right-hand die-head H_1 come in contact with end Q_1 of the work-piece, they move the work-piece and the floating carriage E to the left until the other end Q of the work-piece comes in contact with the chasers of the left-hand die-head H. Both die-heads then start to thread the bar stock simultaneously.

Fig. 4 shows diagrammatically the combined tripping and locking mechanism and coolant system for the right-hand die-head. Coolant is fed into the die-head H_1 by tube M_1, which passes axially through spindle S_1. Thus, the chips are continuously washed from the die-head. This tube is free to slide longitudinally inside the spindle. The tube is kept in the die-head by the tension of spring L_1.

Tube M_1 also serves as an internal trip for unlocking the die-head. The tube is so positioned that, when the threaded end of the work Q_1 comes in contact with the tube end P_1, inside the die-head, the tube is moved to the right and rocks the horizontal cross-lever A_1 about pivot B_1. This lever, when moved to the right, pulls the tripping tube C_1, which slides on the guide

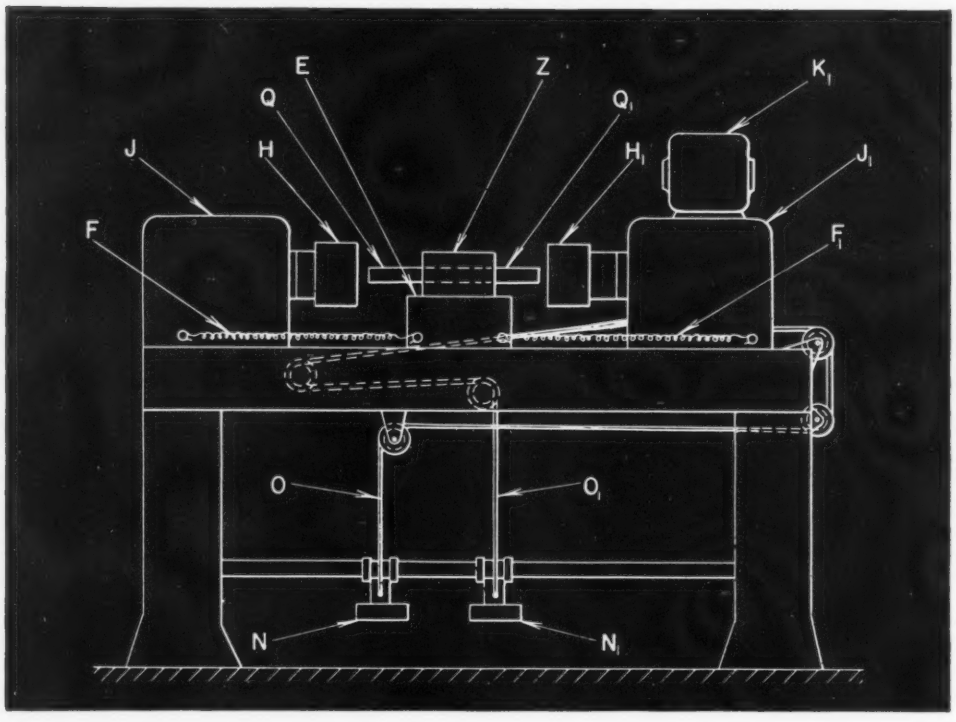
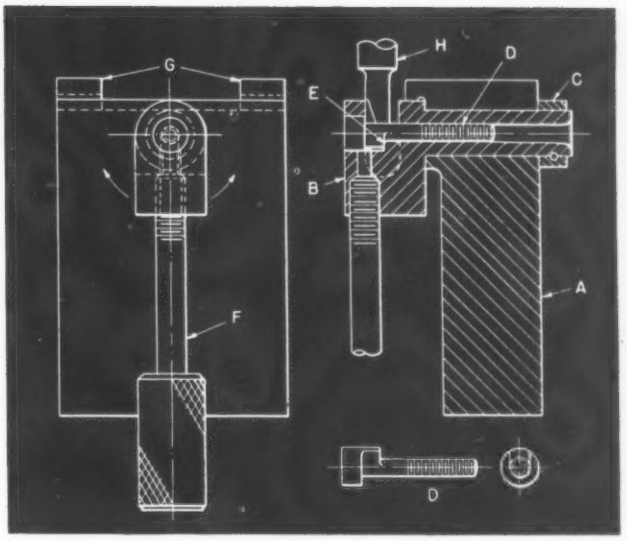


Fig. 3. Auxiliary Headstock J_1, Mounted on the Right-hand End of the Lathe, is Moved to Right and Left by the Pulley, Cable, and Foot-pedal Arrangement Illustrated

bar D, to the right. The tripping tube is attached to the opening yoke F_1 of the die-head. Thus, the die-head is opened exactly at the end of the desired length of thread. Adjustments can easily be made for any length of thread required within the capacity of the machine.

The tripping and coolant system for the die-head at the left-hand end of the machine is similar. The left-hand headstock J, Fig. 3, does not slide, but is rigidly attached to the bed of the machine in the normal manner. After both heads have tripped open at the completion of the threading operation, headstock J_1 is returned to its starting position by depressing foot-pedal N.



Fixture for Milling the Semi-cylindrical Surface and Two Flats Just below the Head of the Special Brass Bolt Shown at D

Special Bolt-Head Milling Fixture

By DONALD A. BAKER, Boonton, N. J.

A semi-cylindrical surface and two flats were required to be milled on the heads of special brass bolts, such as the one shown at D in the accompanying illustration. The fixture shown was designed to handle this job. Using this fixture and a two-lipped end-mill, a production of three bolts per minute was attained.

The cast-iron fixture base A is clamped between the jaws of a vise which is mounted on the table of the milling machine. Work-holding head B is free to swivel about its shank. The shank passes through the base of the fixture and is retained in a horizontal position by a collar C, which is pinned to the end of the shank. The head is bored to receive the bolt D, which is located for machining by offset E, and is held in position by the small-diameter end of the knurled-head screw handle F.

With the work located in the fixture as shown, handle F is swung to one side to rotate the work below cutter H the required amount for milling

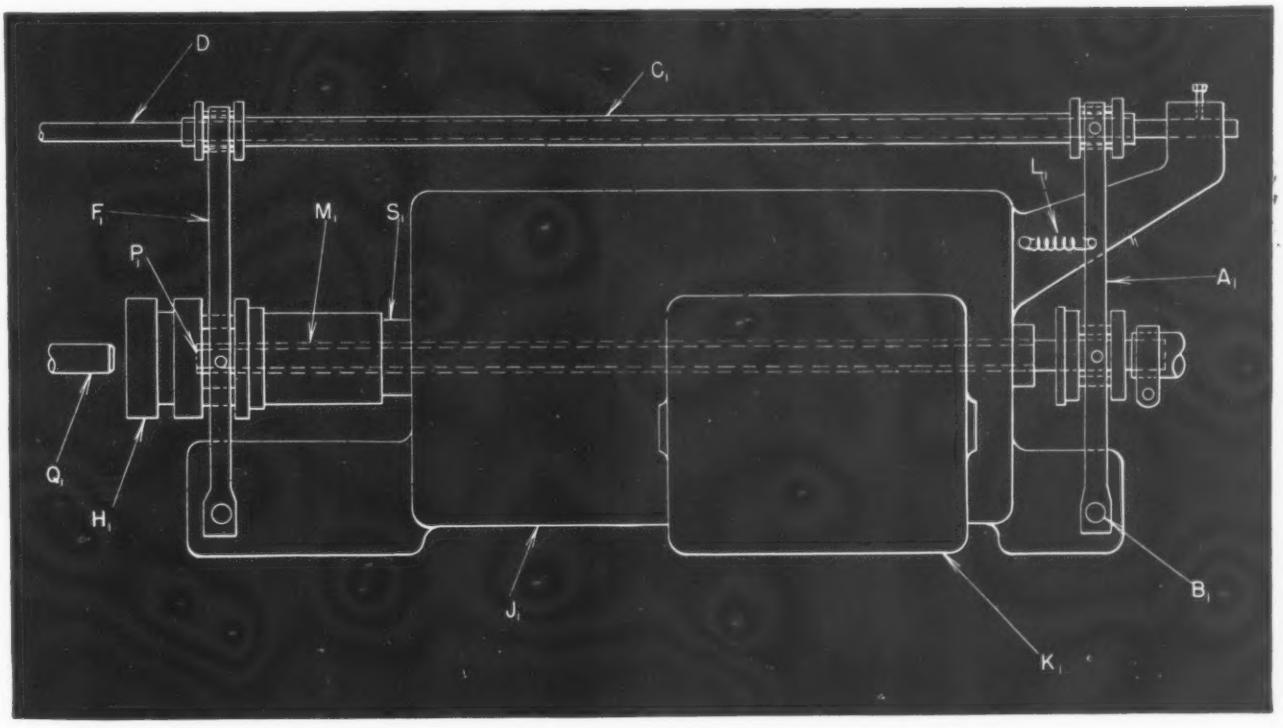


Fig. 4. Arrangement by which Die-head H_1 is Automatically Opened when the Desired Length of Thread has been Completed

half of the semi-cylindrical surface. Rotation of the handle in this direction is limited by a stop *G*. The table of the machine is then traversed for milling one of the two required flats. After the table is returned to its original position, the handle is swung in the opposite direction until the head comes in contact with a stop *G* at that side of the fixture. Thus the other half of the semi-cylindrical surface is milled. The milling machine table is now traversed for milling the second flat.

Fixture Using Modeling Clay to Actuate Holding Clamps

By FRANK J. PERAGINE, Brooklyn, N. Y.

A novel fixture that uses modeling clay to actuate the holding clamps has been in use for some time on production milling and grinding machines. Since the clay is extremely viscous, tolerances for the plunger holes can be large and the clamping plungers made from standard round bar stock. Thus, the fixture is cheaper to build than the conventional oil-operated device, and in addition, the clamping pressure is equalized, so that variations in the work do not interfere with the clamping action.

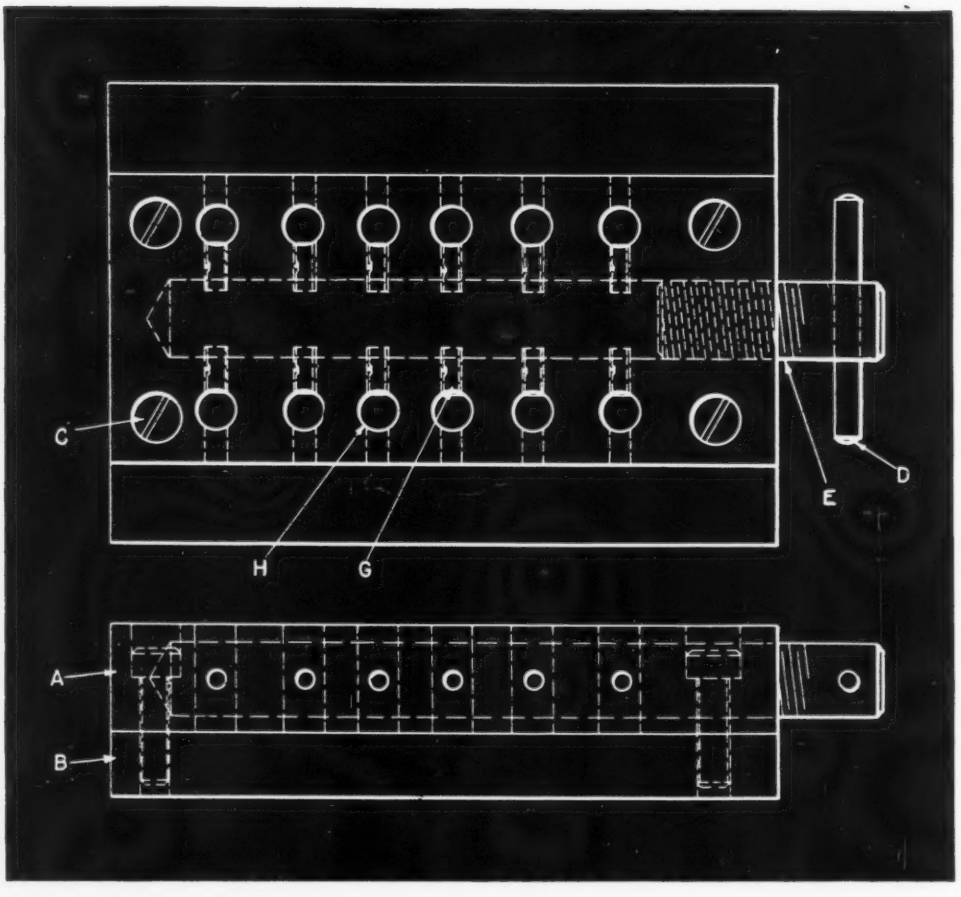
This fixture, which is shown in the accompanying illustration, was machined from two pieces of cold-drawn steel. Machining is simplified by the split construction because the work holes and plunger holes can be drilled through, and the two sections *A* and *B* clamped together by cap-screws *C*. When handwheel *D* is turned, screw plunger *E* applies pressure to the clay in the chamber. This pressure forces plungers *G* against the work, which is located in holes *H*.

Although the fixture shown holds twelve pieces, the same principles can be applied whether the fixture is to hold two or twenty-four pieces. In addition, if production schedules are high, two fixtures can be bolted to the table —one being in operation while the other is being loaded.

* * *

Auxiliary Motor Controls Propeller Pitch

Indicative of the unusual tasks to which motors are sometimes put in aircraft is the use of a Westinghouse motor of 1/3-H.P. capacity, mounted within the hub of a whirling propeller, the function of which is to vary the pitch of the propeller should the hydraulic pitch control fail. The motor is submerged in oil, runs at 11,000 R.P.M., and operates on 400 cycles.



This Fixture, which Holds Pieces for Production Milling and Grinding Operations, Uses Modeling Clay Instead of Oil for Actuating the Work-holding Clamps

THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER Sales Engineering Consultant

Meeting Objections of Potential Customers

"He had me kind of stumped," complained the sales engineer, returning from a call on a prospect. "That fellow has more objections than there are B.T.U.'s in our heat-treating furnace."

One principle to remember, in selling, is that value is created and exists in the mind, partly from experience—proved facts and figures—and partly from impressions based upon mental images. Each object is regarded through the distorted windows of the individual mind. We have prejudices, or "lopsided" opinions. The old car we bought may have given lubrication trouble. In buying the new one, we are "lubrication conscious."

Two corollaries spring from this principle to shape the sales engineer's efforts. First, the necessity of studying the likes and dislikes of the individual prospect; and second, the necessity of framing sales arguments to meet these likes and dislikes, as well as all objections.

Some of the commonest questions and objections raised by potential buyers are as follows:

Why is price so high?—Imagine price on one end of a scale and value (as humanly interpreted) on the other. The quickest way to make value outweigh price is to reduce price. Yet should the scales suddenly drop on the value side, the human factor would again enter in, and value would be held under suspicion. Thus the whole problem of the sales engineer is that of establishing value in the mind of the prospective purchaser—the value of his equipment to continuously give profitable results, and the value of the sales engineer and his company to successfully serve the buyer. Value can be built up in the prospect's mind through skilled sales engineering to make the scales drop in its favor.

Can't you speed up delivery?—How often the prospect has exclaimed, "We can't wait that long for your machine. We can get an equivalent machine of another make quicker. Time means money to us." Are the prospect's statements distorted? Are certain accessories required from sources other than your company that will hold up complete installation? Are your competitor's delivery dates reliable? These are all points for the sales engineer to check. Should delivery be the "bottleneck," then the sales engineer's job is again to establish value sufficiently well in the mind of the prospect to overcome any handicap due to long delivery. Even though the sales engineer may fail in this case, his effort is not wasted.

Will the machine actually produce promised results?—The sales engineer must not only establish in the mind of the prospect full appreciation of the quality of the equipment he offers, but his own and his company's ability to apply it to the particular job. Value depends upon selection and application. Nothing is much worse than a machine that is improperly applied or one whose purchase proves economically unsound. Such a machine is a millstone about the sales engineer's neck.

Will the newly designed machine work?—The initial sale of a newly designed machine is often a problem. It calls for confidence and initiative on the part of the sales engineer in selling. "How do I know it will work?" thinks the prospect. "Why pick me for a guinea pig?" Such questions can best be met before they are asked. Establish the fact that the prospect has been selected because he is progressive; that the new design has been subject to endless tests and trials; that the new features actually accomplish most attractive results; also, that these results will place the purchaser in a better competitive position to meet his market.

We want to keep our machines uniform.—"All of our drill presses are made by X," says

a prospect. "We want to keep them uniform. Our men are used to them. This practice saves on repairs." An alert sales engineer will have found out why and how frequently X drill presses need repair. Stimulated by the thought that the X representative is getting all the business, and is perhaps over-confident and lax in his selling efforts, the competing sales engineer can stress the merits of his drilling machine—its high output and low maintenance. He can prove how thoroughly machine operators like it. He will diplomatically suggest that his repeated calls and information on drilling equipment have really benefited the purchaser by affording a selection of equipment and that this effort should be rewarded. He will stress the wisdom, in this case, of two sources of supply.

Objections, instead of being obstacles, should be helpful signposts to the sales engineer. They reveal, guide, and focus. They should be encouraged, attentively listened to, and met pleasantly and intelligently. The successful sales engineer will figure them out in advance, and attack them with deliberation and tact.

Clayton R. Burt Becomes President of Newly Formed Potter & Johnston Co.

CLAYTON R. BURT recently resigned as chairman of the Niles-Bement-Pond Co., West Hartford, Conn., to clear the way for his acceptance of the presidency of the newly formed Potter & Johnston Co., which will take over the business of the former Potter & Johnston Machine Co., Pawtucket, R. I. The Niles-Bement-Pond Co. has purchased the patents, patterns, jigs, fixtures, drawings, and all the work in process inventory of the concern mentioned, which will be operated as a subsidiary under Mr. Burt's leadership.

The plant and manufacturing equipment will remain under the ownership of the old company, which is to be known henceforth as the Darlington Industrial Corporation. The Niles-Bement-Pond Co. has leased the plant for a term of years, and will carry on operations at Pawtucket.

Under the new management, J. Earle Makant will continue in charge of plant operations, J. Potter Cunningham in charge of sales, and Carl A. G. Birkedal in charge of accounting. The present personnel of both factory and office will be retained.

Norman R. Earle, who was executive vice-president of the Potter & Johnston Machine Co., and who has served the company in various capacities for forty years, will be executive vice-president of the Darlington Industrial Corporation, and Jacob Ziskind will be president and treasurer.

Blank & Stoller

Clayton R. Burt, President of Potter & Johnston Co.

Mr. Burt has given twenty-four years of outstanding service to the Niles-Bement-Pond Co. It was under his leadership that the company moved from the original buildings in Hartford to its present modern plant in West Hartford. He is a past-president of the National Machine Tool Builders' Association and the Hartford Chamber of Commerce, and is a member of the board of directors of many industrial concerns.

* * *

Foamglas Insulation Developed for Indoor or Outdoor Application

In the past, it has been difficult to use one type of pipe insulation for all applications, since a certain kind was usually best suited for indoor use and another kind for outdoor use; one type was required for insulating cold lines, while another was necessary for application on hot lines. Now, however, the Pittsburgh Corning Corporation, Pittsburgh, Pa., has developed a glass pipe insulation that can be applied over a temperature range of from minus 200 degrees F. to plus 800 degrees F., and is equally adaptable to indoor or outdoor use. This Foamglas material is said to retain its original insulating efficiency permanently. It is unaffected by humidity, is highly resistant to fumes, vapors, and acid atmospheres, and, of course, is non-combustible.

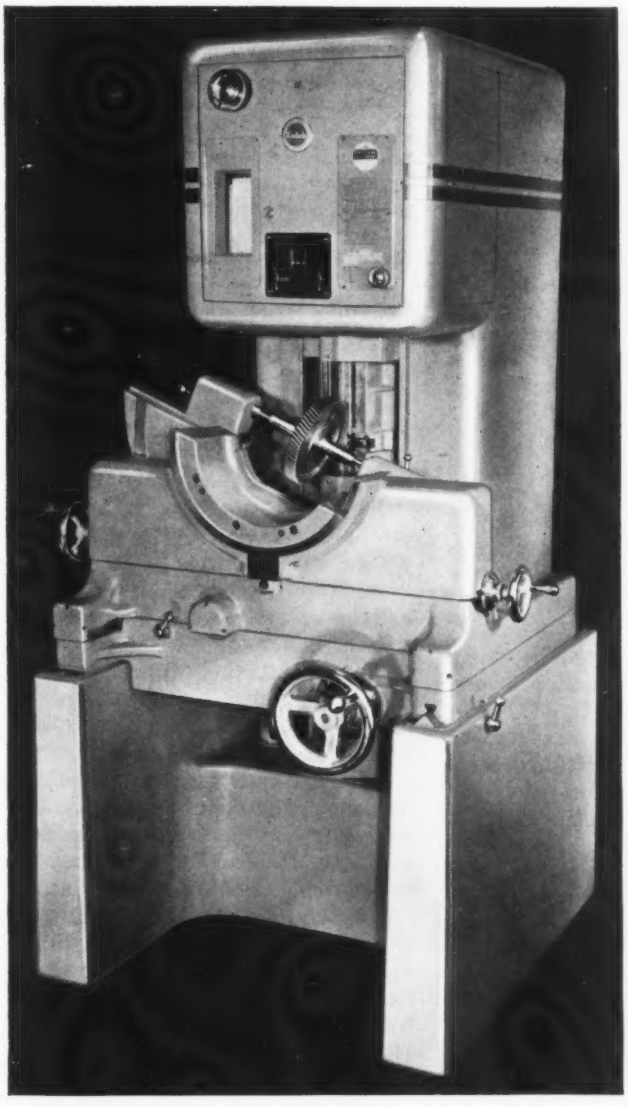
Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Eastman Kodak Gear-Testing Equipment and Contour Projector

Gear-testing equipment and a contour projector in which outstanding new features of design have been incorporated were exhibited by the Eastman Kodak Co., Rochester 4, N. Y., at the recent Tool Engineers' Show in Cleveland. The new gear-testing equipment, designated the "Conju-gage," is made in three models designed to provide quick and economical means for checking composite errors in gears ranging in size from the smallest watch pinions up to gears having pitch diameters of 8.25 inches. The largest model "Conju-gage," is shown in Fig. 1, while the smallest model, which accommodates gears with pitch diameters up to 1.25 inches, is shown in Fig. 2. The intermediate size gage will test gears having pitch diameters up to 4.125 inches.

A new concept of gear inspection, based on the use of a gaging element produced as a single-threaded worm, is the outstanding feature of these "Conju-gages." The new gaging element, called a master worm section, has the appearance of a rack, as shown in Fig. 3. It can be used to check both spur gears and right- or left-hand helical gears, regardless of the helix angle. The



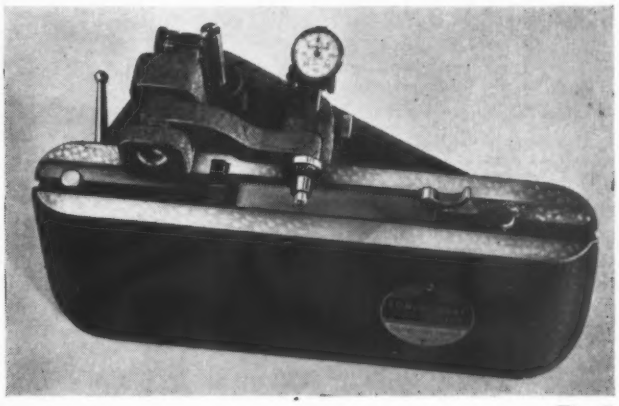


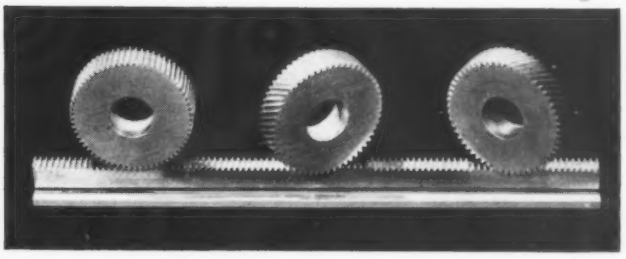
Fig. 2

Fig. 1. (Left) "Conju-gage" Developed by Eastman Kodak Co. for Testing Spur and Helical Gears with Pitch Diameters up to 8.25 Inches

Fig. 2. "Conju-gage" Designed for Testing Spur or Helical Gears of Any Size, from Small Watch Pinions up to Gears with Pitch Diameters of 1.25 Inches

Fig. 3. View Showing how a Spur Gear and Right- and Left-hand Helical Gears of the Same Normal Pitch Line and Pressure Angle can be Meshed with the Master Worm Section

Fig. 3



To obtain additional information on equipment described on this page, see lower part of page 222.

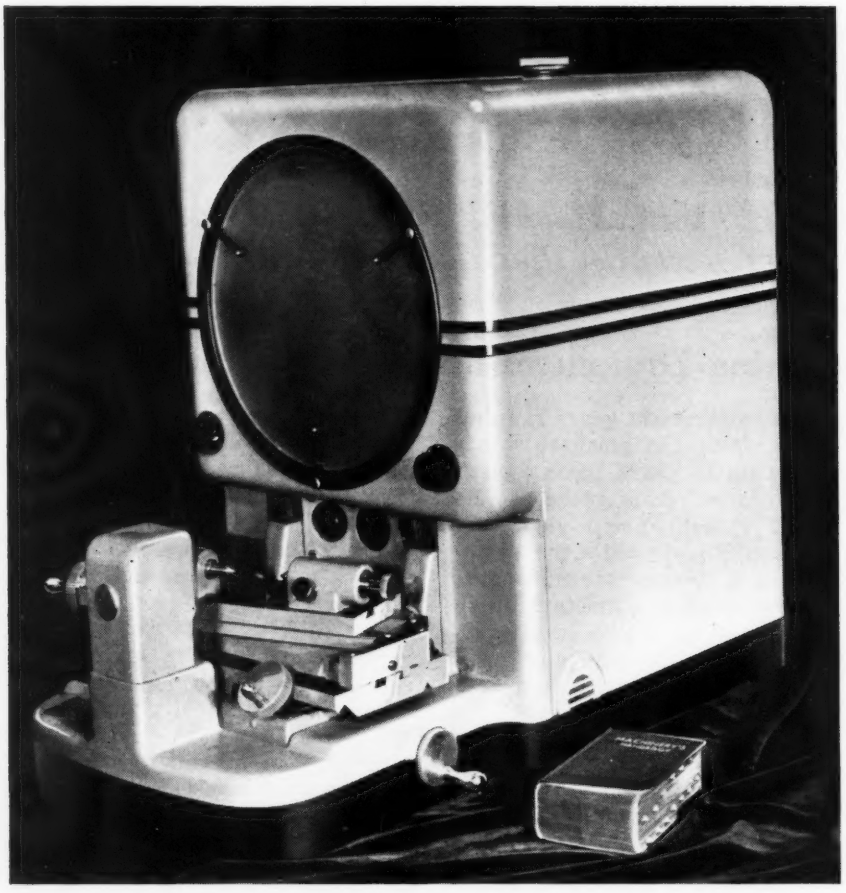


Fig. 4. Contour Projector Developed by the Eastman Kodak Co. to Facilitate Rapid, Accurate Checking of Precision Parts

master worm section is incorporated in a testing instrument of the variable center-distance type.

The gear being tested is meshed with the rack-like master worm section, which is traversed along its axis, the variations in center distance being measured either directly on a gage or by an automatic charting device. In the latter case, separate errors which make up the composite error, such as profile error, tooth thickness error, tooth-spacing error, eccentricity, and run-out, can easily be evaluated from the chart.

The chief advantages claimed for these instruments are inherent in the master worm section. Since this element is ground as a section of a worm, on a thread grinder, it can be held to extremely close tolerances. The design of the master worm section is based on the same principle as the familiar gear-cutting hob. If, instead of rotating a hob, for example, we impart an axial movement to it, its action will be the same as that of the master worm section in its gage. A hob of a given pitch and pressure angle will generate gears of similar normal pitch and pressure angle, regardless of the helix angle. This versatility is also a feature of the worm section of the inspection equipment. Thus gears with helix angles up to 45 degrees can be readily checked by positioning them in centers mounted on an "arced" sector in the work-slide, as seen in Fig. 1, so that they mesh with the master worm section on the vertical slide.

Another advantage of the master worm section is that it can be reground many times. The master worm section can also be made in very fine pitches; some as fine as 125 diametral pitch, for instance, are now being used in the company's plants. No special center-distance corrections are necessary when non-standard gears are checked. The operating and standard pressure angles are always the same in a master worm section.

The master worm section, being part of a helicoid and curved in the transverse plane, can be used to advantage in checking gears for crown or taper by moving the gear at right angles to the worm section. Worm sections can be made in non-involute forms, such as epicycloids, or as conjugates to modified involutes. The master worm section can be used to measure backlash without requiring specially proportioned teeth. Increasing the lead-angle setting has the same effect as increasing the normal tooth thickness.

The new Eastman contour projector, shown in Fig. 4, was developed to facilitate rapid, accurate checking of precision parts in the company's own plants. It embodies a number of principles not previously incorporated in instruments of this type, in which the magnified image of a part is compared with a master tolerance chart or drawing.

This projector is designed to provide adequate staging space between the part and the first lens, even at the highest magnification; give uniform, brilliant illumination, so that the instrument can be used in fully lighted rooms without hoods and curtains; and facilitate operation by eliminating the need to refocus or make other adjustments when the magnification is changed.

The unique optical system provides a constant working distance of 8 inches between the part and the first lens of the projection system. This distance is maintained at all magnifications. Over-sized and awkward fixture design is avoided by providing adequate table motions for convenient positioning of fixtures. All optical distortion is held below measurable limits over the entire magnified area, with the result that the desired dimensions can be compared directly on the master chart on the screen.

The optical unit provides screen brightness approximately ten times greater than that available with conventional comparators. A rheostat is provided to diminish the light intensity as desired. For measuring surface features or sections of an object where the profile is obstructed, such as punches, cavities, or engravings, two powerful auxiliary surface illuminators behind heat-absorbing windows provide a bright image in natural color on the screen instead of a shadow image. Both a surface image and

To obtain additional information on equipment described on this page, see lower part of page 222.

a profile image can be projected at the same time.

Other features include enclosed surface illuminators; a lens turret for mounting up to five projection lenses of assorted powers to 100X, which are indexed by simply turning a knob; a helix table for positioning threaded parts at the proper angle to the light beam, so that a normal plane is projected; and an attachment for vertical inspection of thin parts where it is more convenient to direct the light through a transparent work support.....61

"Red Ring" Universal Diagonal Gear-Shaving Machine

The National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich., has announced a new "Red Ring" universal diagonal gear-shaving machine which can be used to shave gears by either the diagonal or the conventional method. Any gear being shaved conventionally on this machine can, at the same time, be given an elliptoid tooth form by rocking the table as it is reciprocated. The degree of crowning and the position of crown are both selective.

The new machine will handle any conventional shaving operation, in which the gear is automatically reciprocated parallel with its axis across the cutter and automatically fed into the cutter vertically at the end of each stroke. This practice is especially desirable for gears having wide face widths.

Gears with face widths up to approximately 2 inches can be shaved by the diagonal table-traverse method, in which the gear is automatically reciprocated, at a diagonal angle to its axis, across the cutter and back, for a total of two strokes. With this method, the center distance between any specific work-gear and the cutter remains constant. This method of diagonal shaving is said to materially reduce shaving time, prolong cutter life, assure closer control of the lead of helical gears, facilitate the shaving of shoulder gears, and reduce both loading time and operator fatigue.

Gears being shaved diagonally can also be crowned by rocking the table by means of an adjustable cam. As in the case of conventional shaving, the degree of crown is selective and the crown may be positioned at will. Any type of gear may also be taper-shaved when using either conventional or diagonal shaving.

The principle of rotary crossed-axes shaving has been retained as a basic characteristic of this machine, as has the precision adjustment of the cutter-head to obtain any desired angle between the axes of the work-gear and the cutter. A new "fast-lock" tailstock has been installed which facilitates loading and unloading the work.

This machine can be changed from diagonal to conventional shaving in a matter of minutes. It is available in two models, the smaller model having a capacity for handling gears with pitch diameters ranging from 1 to 8 inches, while the larger model will accommodate gears with pitch diameters of 1 to 12 inches.....62

Airco Electrode for Welding Mild Steel

A new all-position arc-welding electrode for welding mild steel, designated "Airco No. 387," has been developed by the Air Reduction Sales Co., Department 1815P, 60 E. 42nd St., New York 17, N. Y. It is designed to meet the need for an electrode of the E-6012 class with the following

"Red Ring" Universal Gear-shaving Machine for Finishing Gears by either the Conventional or Diagonal Shaving Method

To obtain additional information on equipment described on this page, see lower part of page 222.

characteristics: Smooth bead of proper contour; excellent operating characteristics and minimum spatter on either alternating or direct current; satisfactory operation in all positions, especially when welding vertically downward; maintenance of a high degree of welding performance throughout the entire length of the electrode when high welding currents are used; exceptionally easy slag removal; and production of welds of maximum length per electrode. This electrode is made in 1/8, 5/32, 3/16, and 1/4 inch sizes. 63

Natco Multiple-Spindle Drilling and Tapping Machines

A new line of high-speed sensitive multiple-spindle drilling and tapping machines has been announced by the National Automatic Tool Co., Inc., Department 40, Richmond, Ind. This line includes both heavy- and light-duty machines—Models H-5 and H-6, which will replace the preceding G-5 and G-6 models. The two new machines are of similar design and vary only in size of drilling area of head, horsepower of head driving motor, number of spindles in head, and size of work-table. The new line makes available machines for handling a wide range of jobs on small steel, cast-iron, wood, and plastic parts.

These machines can be furnished for drilling only, for tapping only, or for either drilling or tapping. Quick-change gears and a quick-change speed mechanism facilitate the selection of correct spindle speeds for a wide range of drilling and tapping operations. The spindles can be adjusted vertically to compensate for changes in drill lengths. Provision is also made to permit the spindle to float when performing tapping operations. Reversing type motor drives eliminate the need for belts and clutches for tapping operations.

The tables can be arranged for either a combination hand and foot feed or a hydraulic power operated feed, the feed being 2 1/4 inches in either case. The hydraulic feed can be controlled by a manually operated lever which can be set for semi-automatic cycle operation. The table is then electrically controlled by a foot-operated treadle switch.

Interchangeable slip spindle plates for several different spindle set-ups can be bolted to the head flange of the machine. This type of spindle equipment is especially adapted for use on machines requiring several set-ups which are frequently changed from one machine to the other. It is designed to insure accurate location and alignment of the spindles.

The new machines can be provided with a deep-hole drilling or step drilling attachment at ad-

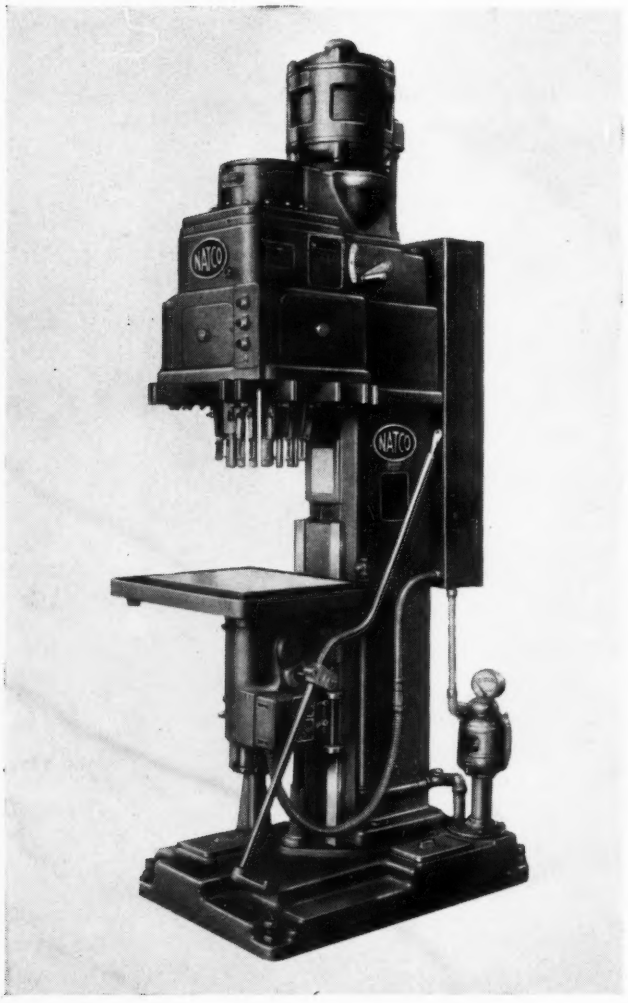


Fig. 1. Natco Multiple-spindle Drilling and Tapping Machine Equipped with Manual Feed

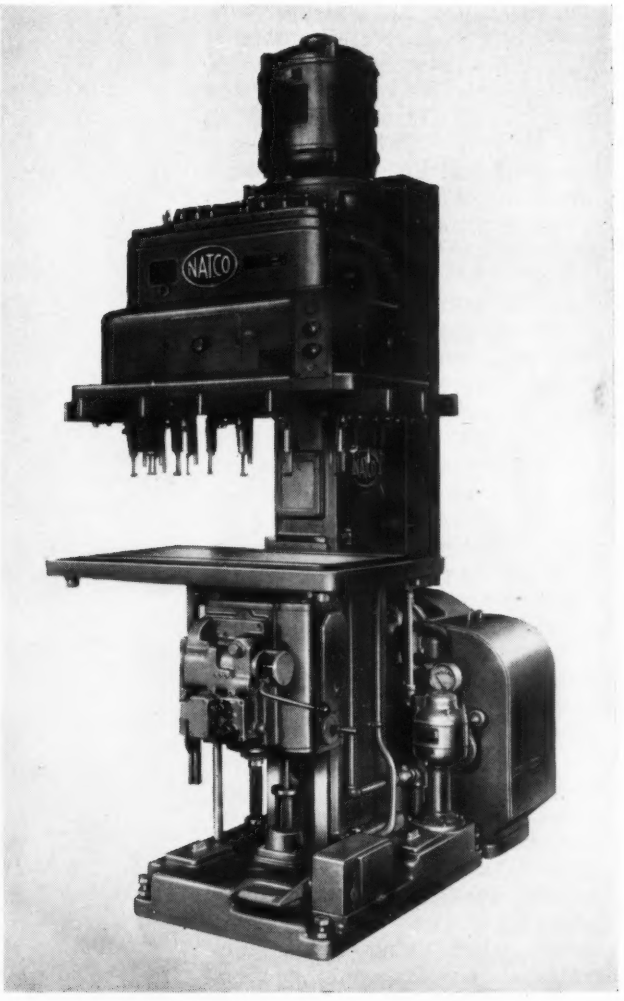


Fig. 2. Natco Multiple-spindle Drilling and Tapping Machine Equipped with Hydraulic Feed

To obtain additional information on equipment described on this page, see lower part of page 222.

Fig. 1. Improved Cutter and Tool Grinder Brought out by the Cincinnati Milling Machine Co., Equipped with Universal Work-head

Fig. 2. Side View of Cincinnati Cutter and Tool Grinder, Showing Cylindrical Grinding Attachment Mounted on Work-head

ditional cost. The machines will take fractional-size drills ranging from 1/16 to 1/2 inch in diameter, and taps from 1/16 to 5/8 inch. The H-5 machine has an over-all height of 96 7/8 inches, and weighs 2600 pounds equipped with hand and foot feed, and 4000 pounds when equipped with hydraulic feed. The H-6 machine has an over-all height of 99 inches; with hand and foot feed it weighs 3000 pounds and with hydraulic feed, 4500 pounds. 64

Cincinnati Cutter and Tool Grinder

Improvements developed primarily to facilitate operation and lessen routine service requirements have been incorporated in the No. 2 cutter and tool grinder built by the Cincinnati Milling Machine Co., Cincinnati 9, Ohio. Preloaded precision anti-friction type bearings, packed in grease to insure life-time lubrication, are employed for the grinding-wheel spindle. Dual hand table traverse knobs, usually located at the rear of the machine, are now duplicated at the front.

Vertical adjustment of the grinding-wheel head has been increased 3 inches to provide a total movement of 10 1/2 inches. Electrical controls are recessed in a compartment at the front of the machine. A switch shuts off the current when the electrical compartment door is opened. Another safety feature is provided by the transformer unit supplied for shops operating on high voltages. This transformer reduces the current to 110 volts at the push-button station. Built-in start and stop push-buttons are provided for both plain and universal machines. The universal machines are also equipped with a two-way switch for the motor of the cylindrical grinding attachment.

A face-mill grinding attachment, long reamer-grinding attachment, spring collets, etc., and two types of wet grinding attachments are now available, in addition to a wide variety of regular attachments. One of the wet grinding attachments, designed for cylindrical grinding operations, incorporates a motor driven pump and tank unit, which is built into the machine base, and includes splash guards around the table and wheel. The other attachment, separate from the machine, is designed for carbide grinding operations. A motor-driven coolant pump and tank and an air-suction pump are combined in one unit. A thin stream of coolant directed to the wheel is disintegrated into tiny drops by the rapidly revolving wheel. The air suction returns the moisture to the tank, keeping the table and machine dry while the wheel and work remain clean and cool.....65

Shell Drill Lubricator and Saw-Blade Lubricant

Two new products for the metal-working industry—a drill lubricator and a saw-blade lubricant—are now being marketed by the Shell Oil Co., 50 W. 50th St., New York 20, N. Y. These products have been developed to prolong the life of tools and increase their operating efficiency. The drill lubricator, used principally with hand-operated automatic tools up to the 1/2 inch size, is said to have reduced drill breakage as much as 22 per cent and to have decreased drilling time up to 20 per cent.

The new saw-blade lubricant, besides increasing cutting speeds and prolonging blade life, is said to reduce cutting temperatures and vibrations. 66

To obtain additional information on equipment described on this page, see lower part of page 222.

Brown & Sharpe Plain Milling Machine with New Spindle Drive

The Brown & Sharpe Mfg. Co., Providence 1, R. I., has announced that the many productive features of its 3-H.P. spindle drive No. 12 plain milling machine, used extensively during the war for fast milling work, have been incorporated in a new electrically controlled 7 1/2-H.P. spindle drive machine. The new machine is designed to take heavier cuts, and has capacity for moderate-sized carbide milling jobs. Its power is applied through a separate spindle motor, designed to give maximum effective cutting capacity combined with economical operation.

There are twenty-one spindle speeds ranging from 25 to 1790 R.P.M. in either direction (twenty-four intermediate speeds are also available), in addition to twenty-eight separate rates of feed, from 1/2 inch to 35 inches per minute. The table has sixteen rates of feed ranging from 1/2 inch to 17 1/2 inches per minute, which can be automatically doubled at any desired point in the cutting feed, or sixteen rates of feed ranging from 1 to 35 inches per minute which can be automatically halved. This feature of dual table-feed rates can be used frequently to reduce the length of the milling cycle.

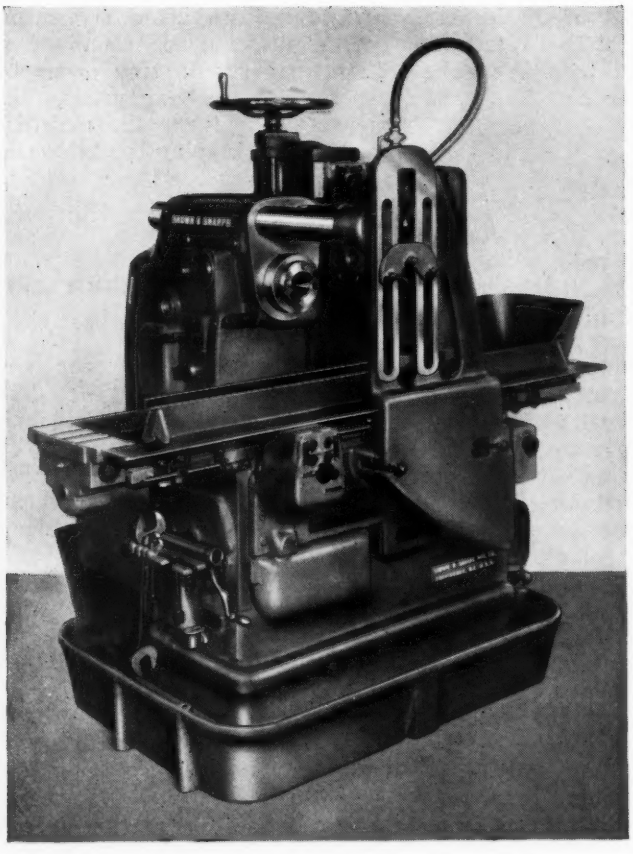
Automatic table reverse when operating at the cutting feed, so that the table continues at the cutting feed rate in the opposite direction, permits rough- and finish-milling at one loading of the work, using dual feed rates if desired. On many types of work, climb milling in either direction can be used up to the capacity of the driving motors, the built-in backlash eliminator on the table feed-screw being released automatically during fast travel.

Two fixtures can be employed with one set of cutters, conventional milling being performed on work at one end of the table and climb milling on work at the opposite end. This arrangement makes cutting practically continuous by eliminating non-productive loading time. The ample power of this machine often makes it possible to combine several cuts in one operation, thus eliminating additional set-ups. 67

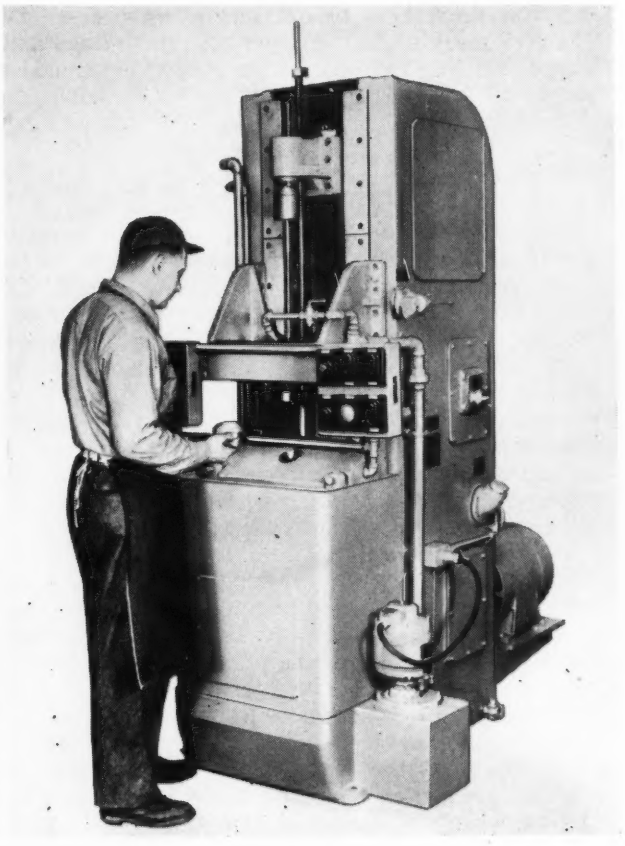
Vertical Pull-Up Hydraulic Broaching Machine

The American Broach & Machine Co., Ann Arbor, Mich., announces a new addition to its line of vertical pull-up hydraulic broaching machines designed for the high-production internal broaching of small parts. The operating principles of the new machine are practically the same as those of the regular vertical pull-up hydraulic broaching machines of this company's manufacture. It is equipped with electrical controls, is push-button operated, and is arranged to complete one full cycle under semi-automatic operation. Provision can also be made, if necessary, to stop the machine at the end of the broaching stroke so that step-cycle operation can be employed.

Multiple tooling can be provided to obtain a higher production rate by increasing the number of broaching stations. Fully automatic operation is possible by



Brown & Sharpe Electrically Controlled Milling Machine with Powerful Spindle Drive



Vertical Pull-up Hydraulic Broaching Machine Built by American Broach & Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 222.

building into the machine a hydraulic interlocked loading slide with a magazine type loading unit. Ample work space is provided between the angle table and the work table.

The machine has a normal broaching capacity of 8 tons, and a maximum broaching capacity of 10 tons. The stroke is 24 inches, and the broaching speed is variable from 15 to 24 feet per minute.

Standard equipment includes coolant pump and piping, hydraulic pumping unit, speed control unit, and pressure gage. Motor and electric starter are furnished as extra equipment. 68

Bliss High-Production Press

The E. W. Bliss Co., 450 Amsterdam Ave., Detroit 2, Mich., has added a 300-ton press to its No. 600 series of high-production presses. The new press, which is the largest of this series, has been installed in the plant of a leading automotive manufacturer, where it is being used to form floor - panel reinforcements in eight steps of a progressive die. The press is completely automatic in operation, and is equipped with a double roll feed and scrap shear, synchronized to feed and trim work to predetermined lengths.

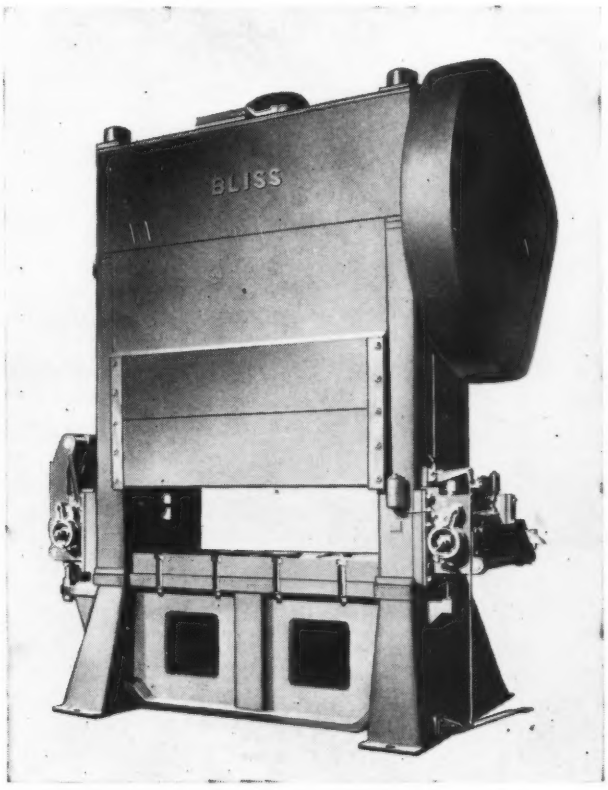
The frame construction is of stress-relieved steel weldments, with bed, uprights, and crown held together by four preshrunk steel tie-rods. The press has single gearing with single end drive, using herringbone gears which run in oil. The air friction clutch is furnished with controls operated by an electric push-button. The bed of the press is arranged to receive die cushions. Lubrication is of the automatic force-feed type.

The press operates at the rate of from 30 to 45 strokes per minute. It has a clear distance between uprights of 84 inches, a slide area 32 inches front and back by 77 inches right and left, and a slide stroke of 6 inches. The die space is 23 1/2 inches from the bed, and 17 inches from the top of the bolster. The bed area is 42 inches front and back by 84 inches right and left.....69

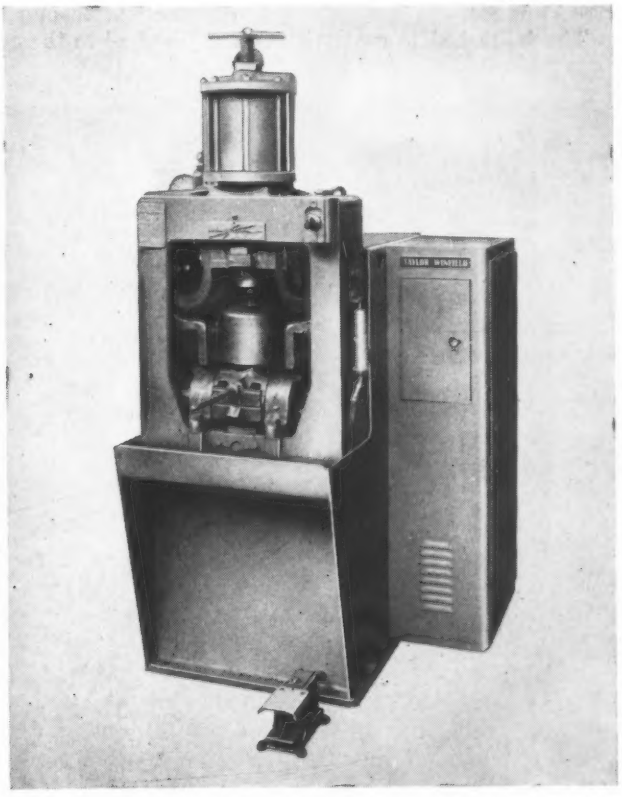
Taylor-Winfield Annular Projection Welder

A welding machine designed to meet the requirements for annular projection welds, including equal distribution of current around the weld, equalized welding force over the weld area, and higher than normal welding current, has been brought out by the Taylor-Winfield Corporation, Warren, Ohio. This welder, rated at 150 K.V.A., delivers 58,000 amperes with the exceptionally low power demand of 348 K.V.A. at a 61 per cent power factor while projection welding electrical terminals to refrigerator motor-housing cases. The box type frame design is said to greatly minimize deflection.

This welder can be obtained with rocking electrodes, to facilitate loading and unloading, or with a stationary lower electrode-holder. The upper electrode-holder is raised and lowered by an air cylinder through guide bearings which are insulated from the upper electrode. 70



High-production Press of 300-ton Capacity Built by E. W. Bliss Co.



Annular Projection Welder Brought out by the Taylor-Winfield Corporation

To obtain additional information on equipment described on this page, see lower part of page 222.

Sidney Tool-Room Lathe

A tool-room lathe with a thirty-two speed pre-selective dial-controlled geared headstock is now being manufactured by the Sidney Machine Tool Co., Sidney, Ohio. The spindle and all long intermediate shafts are supported by anti-friction center bearings, in addition to the conventional end bearing mounting.

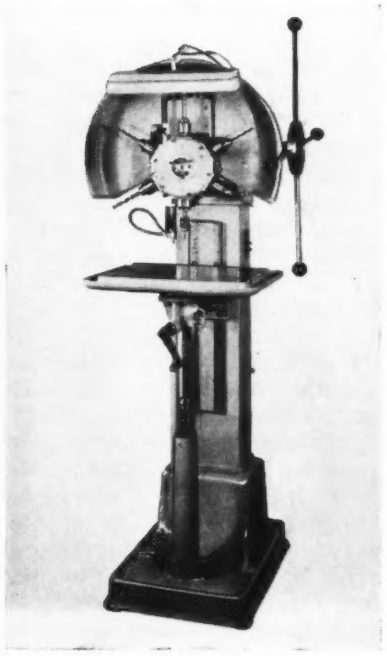
The headstock is so designed that the thirty-two spindle speed changes are accomplished through the use of only sixteen herringbone gears, the gear-shifting mechanism being entirely mechanical. Automatic lubrication is provided throughout the machine. The gear-box is totally enclosed, and all moving parts run in oil. Sixty changes of feed, from 0.0028 to 0.174 inch, and sixty changes for cutting threads from 1 1/2 to 92 threads per inch are available by means of the dial control. The heavy-duty apron is of double-wall construction, with all shafts rotating on anti-friction bearings. A centrally located pump and reservoir provide automatic lubrication to the cross-slide, carriage bed ways, lead-screw, and all moving parts in the apron. The cross and longitudinal feeds are obtained through positive clutches.

The lathe bed is cast with four longitudinal walls, and double cross girts, spaced at 12-inch intervals. The tailstock is furnished with a direct length reading dial to indicate the longitudinal movement of the spindle. A dial is provided that can be reset to zero for drilling blind holes. 71

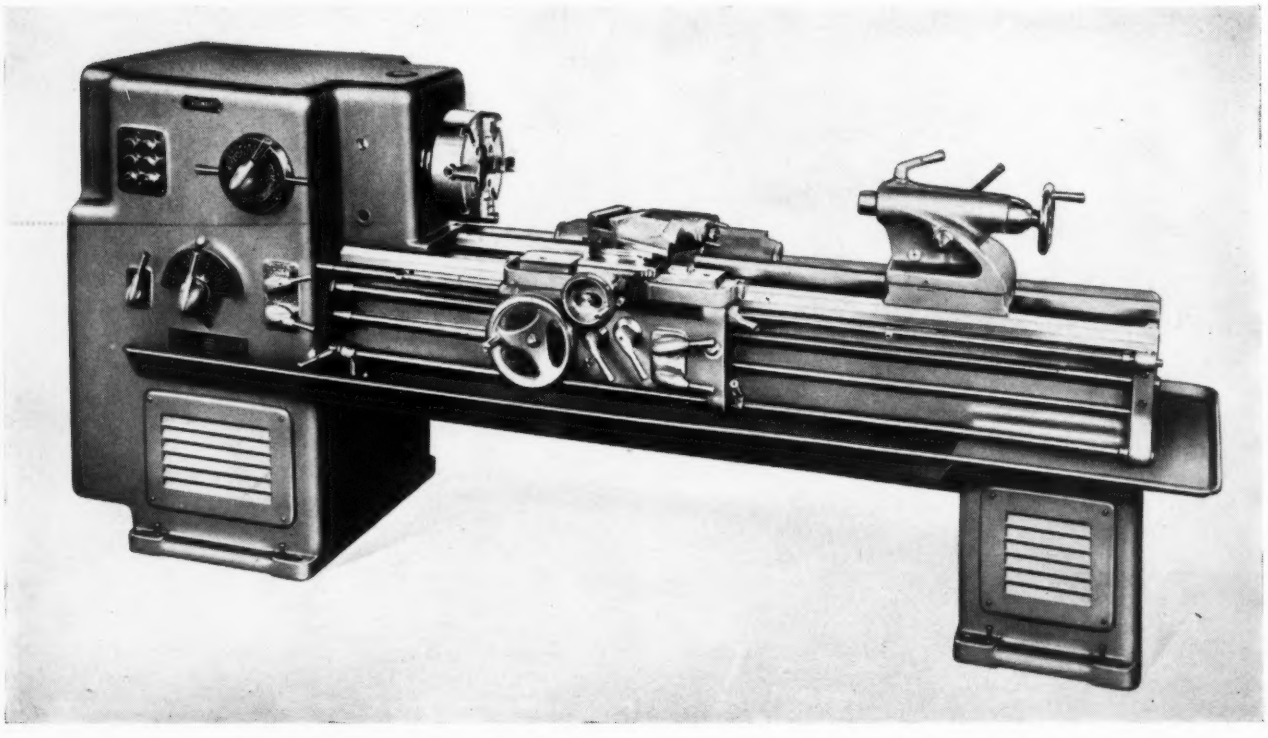
"Burgmaster" Six-Spindle Automatic Drilling and Tapping Machine

An automatic indexing drilling and tapping machine, known as the "Burgmaster," has been placed on the market by the Burg Tool Mfg. Co., Department M, 5028 W. Jefferson Blvd., Los Angeles 16, Calif. Six entirely different operations, such as center-drilling, drilling, reaming, tapping, counterboring, countersinking, spot-facing, recessing, etc., can be performed on this machine without moving the part. Each tool is brought into the operating position with a short movement of the feed handle, and since each spindle has its own individually set depth stop, operation of the machine is very simple.

The machine has a spindle stroke of 4 1/2 inches; it will drill 1/2-inch holes and tap 3/8-inch holes in steel to the center of an 18 1/2-inch circle. Six spindle speeds are available at one setting, ranging from 2600 to 385 R.P.M. These speeds are all pre-selective, permitting the proper spindle speed to be employed for each tool as it is indexed into the operating position. The table has 1/2-inch T-slots and a work surface of 14 by 18 inches. 72



"Burgmaster" Automatic Drilling and Tapping Machine



Tool-room Lathe with Dial Controls Brought out by the Sidney Machine Tool Co.

To obtain additional information on equipment described on this page, see lower part of page 222.

"Packer-Matic" Polishing and Buffing Machine with New Interchangeable Abrasive-belt Heads

Packer Abrasive-Belt Head Automatic Polishing and Buffing Machine

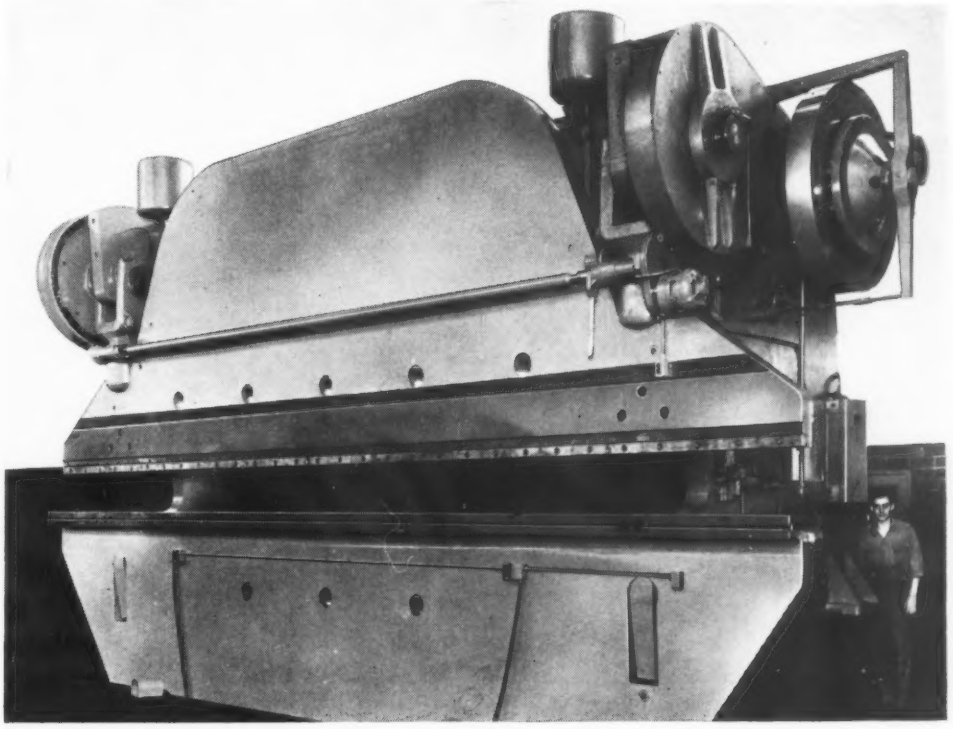
A "Packer-Matic" with newly developed interchangeable abrasive-belt heads has recently been added to the line of automatic polishing and buffing machines built by the Packer Machine Co., Meriden, Conn. The new interchangeable heads are designed for mounting around the rotating work-holding table. This machine is especially adapted for use in small plants and job shops where various products are polished and buffed in small-lot runs.

Standardization of the mounting design makes the abrasive-belt head adaptable to most types of Packer-Matics now in use. The ability of these machines to handle changes in product design without necessitating any change in equipment is greatly increased by the new abrasive-belt head. The flexibility of the head permits single-operation automatic buffing and polishing of such items as door knobs, cooking utensils, hardware, die-castings, and similar products. Various kinds of buffing or polishing wheels, wire wheels, or abrasive belts can be used on the new heads, which are interchangeable and readily adjustable. 73

Cincinnati Two-Housing Mechanical Giant-Size Press Brake

The Cincinnati Shaper Co., Cincinnati 25, Ohio, recently completed a two-housing mechanical press brake for shipyard use, which is believed to be the largest of its type ever built. It has a clearance span between housings of 21 feet 6 inches, and an over-all die surface of 30 feet. The gap or throat in the housings is 24 inches. The machine is capable of bending 30 feet of 3/4-inch thick plate over an 8-inch die opening and shorter lengths of heavier plate. It can also be used for a wide range of multiple or gang punching operations, as well as for bending and forming.

The steel plates from which the main machine members of this press were fabricated are said to include the largest rolled-steel plate ever produced. The housing plates were 10 feet 4 inches wide by 15 feet 6 inches long by 8 inches thick, and weighed 53,000 pounds each. The ram plate was 7 inches thick by 112 inches wide by 30 feet long, and weighed 78,500 pounds. The bed plate was 7 inches thick by 108 inches wide by 30 feet long, and weighed 71,500 pounds. The gross weight of the complete machine is approximately 300,000 pounds. 74



Giant-size Press Brake Built by the Cincinnati Shaper Co.

To obtain additional information on equipment described on this page, see lower part of page 222.

Michigan "Shear-Speed" External Shaper for Cutting Large Gears

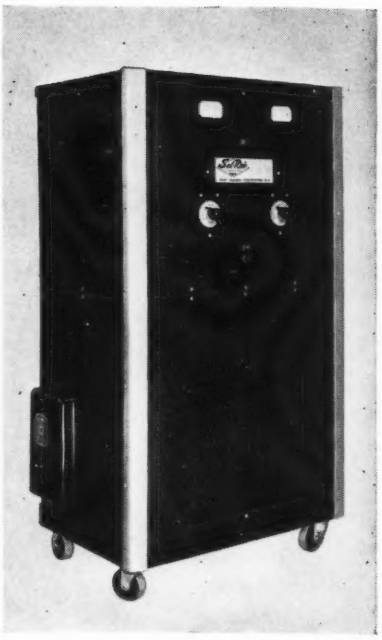
A new and larger "Shear-Speed" external shaper capable of cutting gears, toothed clutches, and external shapes up to 10 inches outside diameter by 2 3/4 inches thick has been added to the line of the Michigan Tool Co., 7171 E. McNichols Road, Detroit 12, Mich. This machine requires a floor space of 86 1/2 by 78 1/2 inches, is 123 inches high, and is driven by a 30-H.P. electric motor. It will regularly handle work from 7 to 10 inches outside diameter, and with special liners will take work as small as 5 inches outside diameter. The maximum stroke of the machine is 3 inches.

A new feature of this machine, which is also being applied to the other three "Shear-Speed" models, is the provision for automatically locking the head in the cutting position; this is accomplished by hydraulically actuated wedge pins which engage corresponding angular wedge surfaces on the two outer extremities of the machine head when the head is lowered into the cutting position. This construction allows the head to be locked in the desired cutting position by a simple initial adjustment of the head stop, thus reducing the time required for adjusting the vertical cutting position to a minimum. 75

Thomas Billet Shear

The Thomas Machine Mfg. Co., Pittsburgh 23, Pa., has recently announced a line of billet shears of improved design. All gears and the motor drive of the new shears are positioned overhead, and all moving parts are enclosed. This design results in a reduction in floor space required of approximately 50 per cent, greater accessibility, and a higher factor of operator safety.

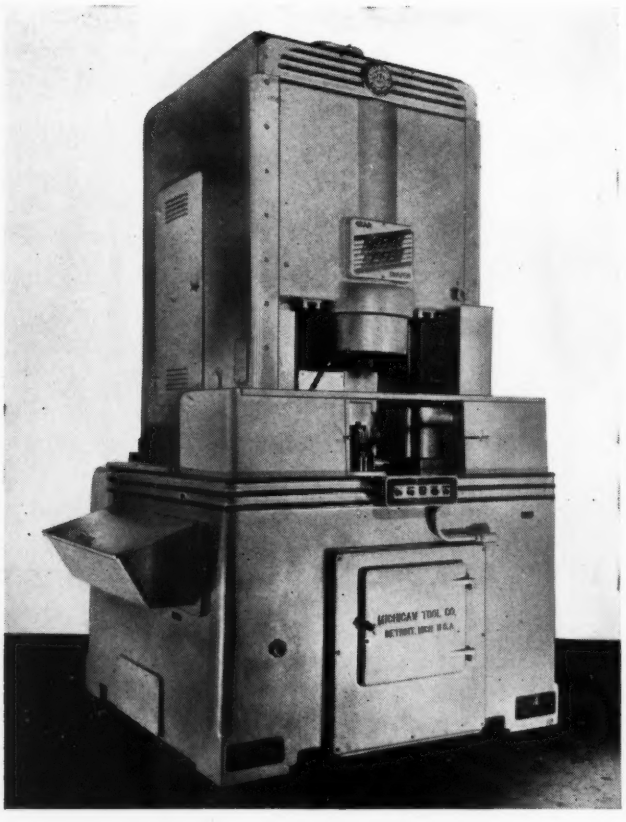
Construction features include all-cast steel housing; air-operated multiple-jaw clutch; and cast-steel herringbone cut gears, operating in an oil bath. The 1200-ton machine illustrated is now being used in a large steel mill to obtain test pieces from structural shapes. 76



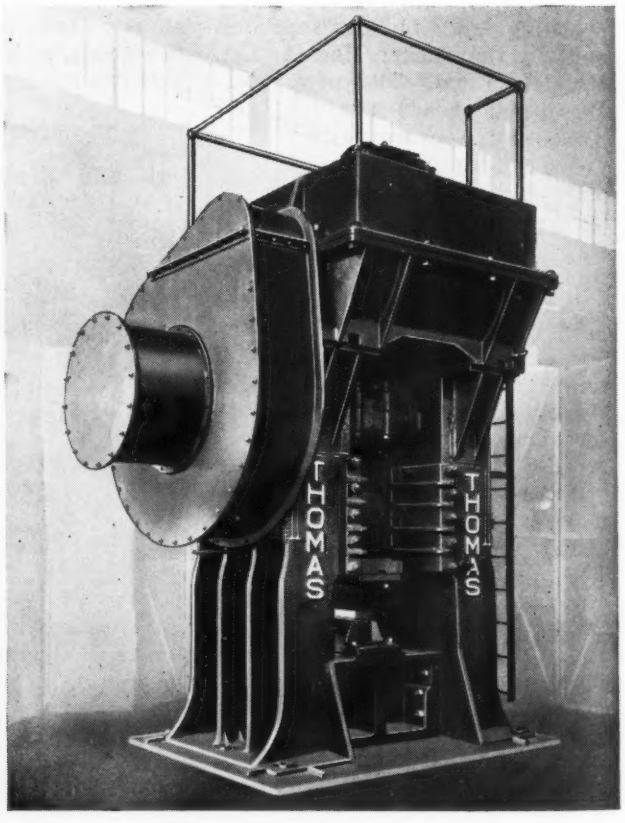
Selenium Rectifier for Electrode Plating Operations

Bart-Messing Selenium Rectifier

The Bart-Messing Corporation, 45 Morgan Ave., Brooklyn 6, N. Y., has introduced a new 9-volt, 2500-



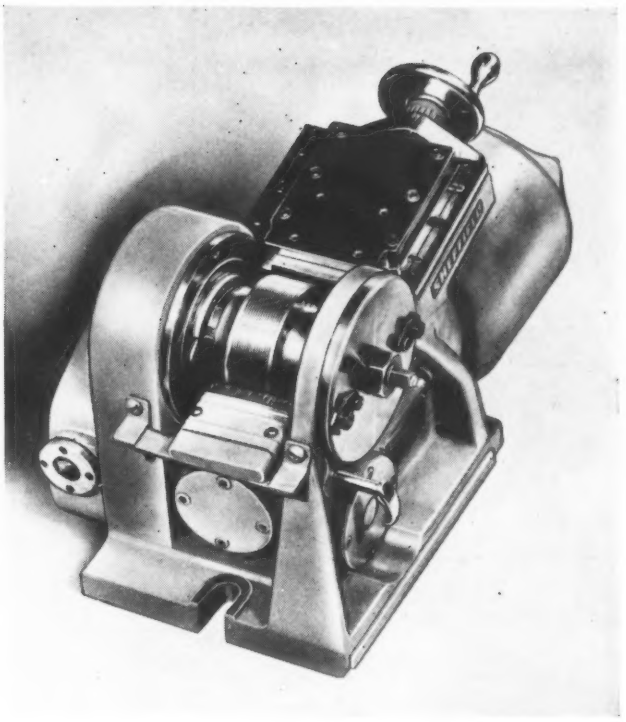
Michigan "Shear-Speed" External Shaper of Increased Capacity



Improved Billet Shear Built by the Thomas Machine Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 222.

Machine for Salvaging Worn Grinding Wheels, Recently Added to the Wickes Brothers Line



Sheffield Self-truing Motorized Crushing Device for Dressing Roll Used to Crush-form Grinding Wheels

ampere selenium rectifier. This rectifier is designed primarily to provide a reserve of voltage for platers desiring to use diluted solutions of chromic acid or other plating baths to conserve their limited supplies of critical materials. Installations made in several large plants indicate that the quality of the plating obtained with a diluted solution when using this rectifier is not affected adversely, and in fact, has shown an improvement and a considerable saving in materials.

The rectifier has an efficiency of over 72 per cent at full load and up to 83 per cent at 20 per cent load. Tap switch adjustment of the output provides voltage adjustment without breaking the current to the tank.

The new selenium elements employed have over 7700 square inches of effective rectifying area, or approximately 310 square inches per 100 amperes. Corrosion protection is provided by a triple impregnation process. Positive overload protection, magnetic starter and push-buttons, and Weston meters and shunt are regular equipment. The unit is 68 inches high, 26 inches deep, and 38 inches wide, and operates on 200, 220, or 440 volts 60-cycle current. It is mounted on casters to permit moving about the plant. 77

Wickes Grinding-Wheel Salvaging Machine

A grinding-wheel salvaging machine has recently been added to the line of equipment manufactured by Wickes Brothers, Saginaw, Mich. This new machine is capable of handling grinding wheels up to 42 inches in diameter by 14 inches thick. Wheels that have served a useful life on one type of grinding machine can be readily reworked for subsequent use on other grinding operations. The outside diameter can be turned down, the sides turned down, or the bore enlarged.

This machine is also suitable for angular forming work on grinding wheels. The machine is driven by a 5-H.P. direct-current motor which permits the main spindle to be driven at any desired speed within a wide range. The weight, including electrical equipment, is 10,000 pounds.....78

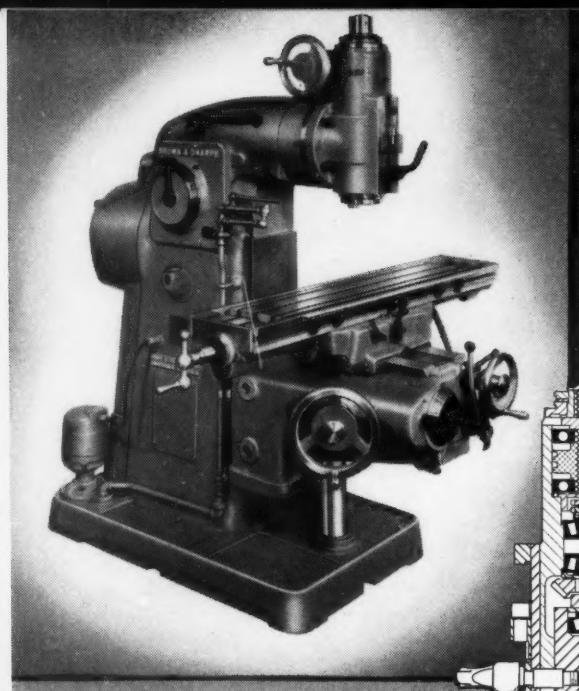
Self-Truing Motorized Roll Crushing Device

A self-truing motorized crushing device, designed for forming cast-iron "crushtrue" rolls and "crushtruing" grinding wheels, has been announced by the Sheffield Corporation, Dayton 1, Ohio. This device is a self-contained, two-spindle unit employing a carbide tool for dressing the form of Meehanite or other close-grained cast-iron rolls, which are then used to crush the grinding wheels. All these operations are performed without removing the roll. The device can be mounted on the table of an 8- by 24-inch, or larger, wet type surface grinding machine.

In the case of some simple shallow profiles, it is possible to form the blank roll directly with the carbide tool. Normally, however, it is recommended that the roll be rough-formed on a lathe and then finish-formed in the crushing device. As the roll becomes worn from repeated grinding-wheel truing operations, the operator simply shifts the clutch to low speed and feeds the carbide tool slowly into the roll until the original form is restored. This requires three to five minutes.

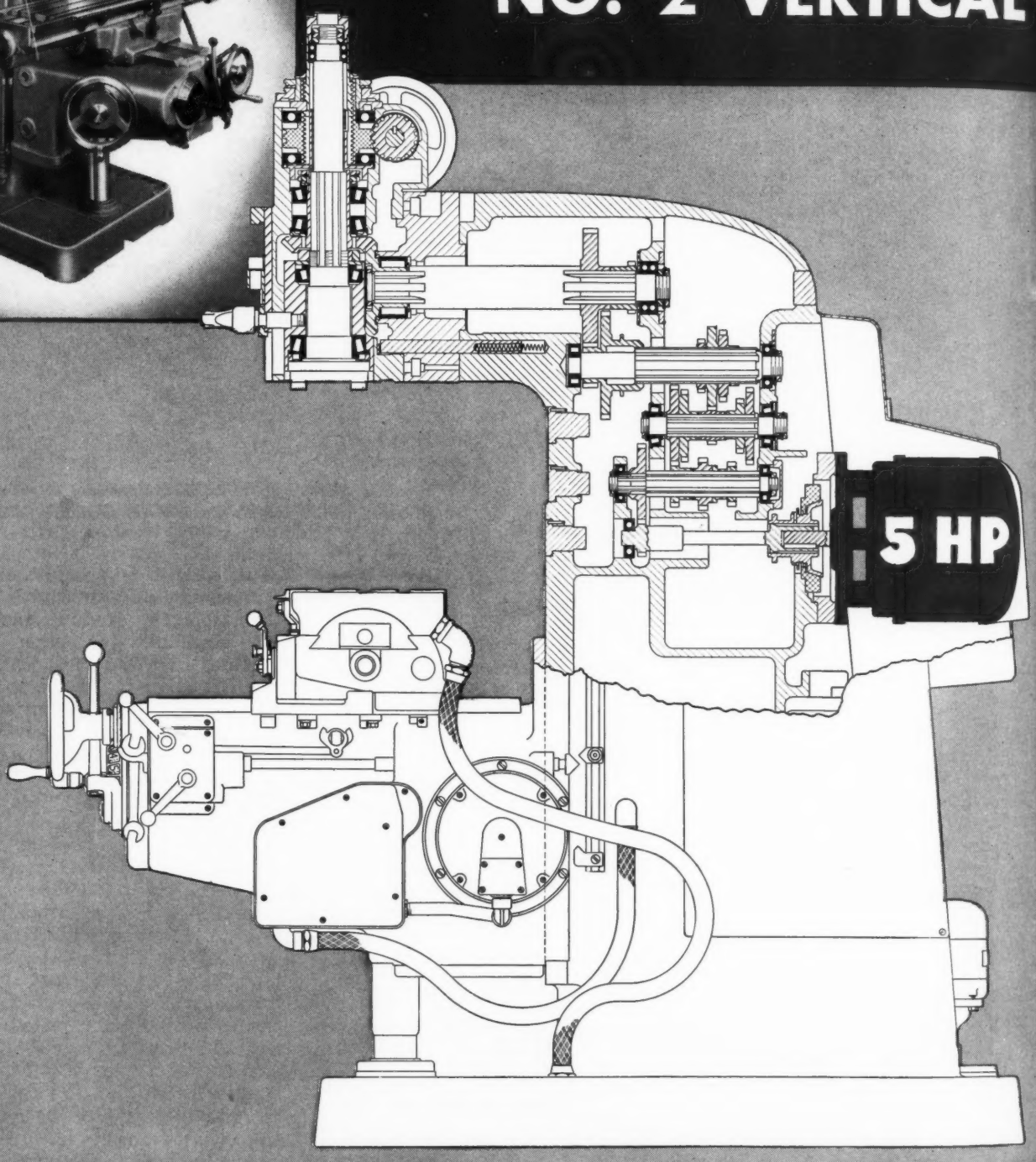
One of the chief advantages of this new crushing device is that all elements of the form are held to close limits of accuracy during the grinding of large quantities of parts on a production basis. This is especially important in grinding thread-rolling dies, laminated sections, punch and die sections, or any flat or cylindrical work of irregular contour.....79

To obtain additional information on equipment described on this page, see lower part of page 222.



NOW A

NO. 2 VERTICAL



CAPACITY — Longitudinal feed 28" — transverse feed, 12" — vertical feed of knee 14¾" — all power. Axial feed of spindle 3", hand. Distance, center of spindle to face of column, 14". 18 spindle speeds, 40 to 1530 r.p.m. 18 feed rates, ½" to 20¼" per minute. 75" per minute power fast travel.

BROWN &

HORSEPOWER
MILLING MACHINE
FOR HEAVIER CUTS

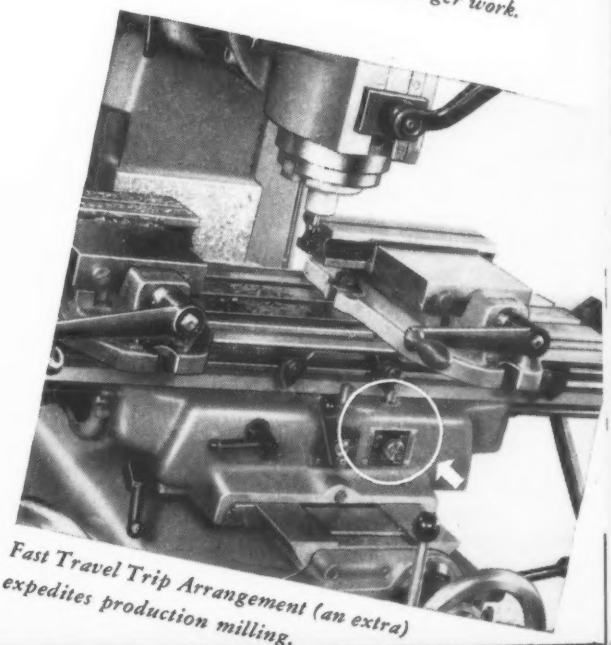
Swiveling spindle head of exclusive design offers quick angular settings.

BROAD UTILITY. This new addition to the Brown & Sharpe line embodies all the production-boosting features of the popular No. 2 Vertical Light Type Machine. In addition, it has greater throat distance, a No. 50 Milling Machine Standard taper hole in spindle, suitable spindle speeds for larger cutters and ample power plus rigidity for work requiring heavier cuts. Full 5 horsepower is available for spindle drive — with individual motors for table drive and coolant pump.

Engineered for smooth, efficient, powerful cutter driving . . . rigid column casting with integral cross bracing; short, large-diameter shafts supported directly in column; anti-friction bearings supporting all shafts in speed train; independent all-gear drives. Features like these assure highly-accurate production and long, trouble-free performance. Write for details. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

Greater throat distance permits milling of larger work.

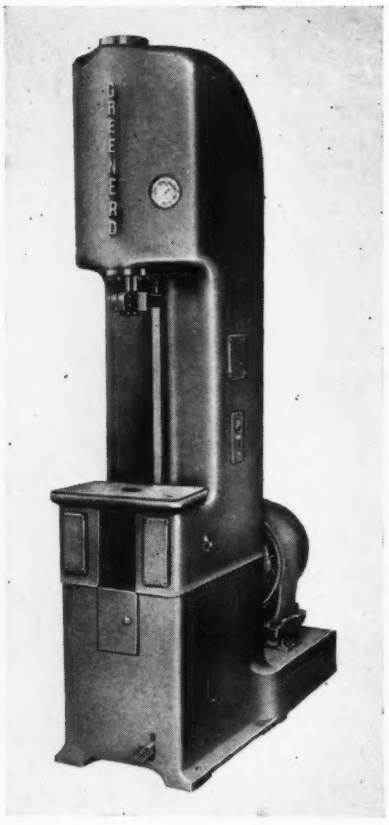
USEFUL ATTACHMENTS. As with other Brown & Sharpe Machines, additional equipment is available for the new 5 H.P. No. 2 Machine — saving time and money on many operations. This consists of Rotary Attachments — Turret Type Spindle Stop — Index Centers — Fast Travel Trip Arrangement — Micrometer Table Setting Attachment — Scales and Verniers — Short Lead and Feed Reducing Attachment.



Fast Travel Trip Arrangement (an extra) expedites production milling.

SHARPE

B·S



Greenerd Streamline Hydraulic Press

Greenerd Hydraulic Presses

The Greenerd Arbor Press Co., Nashua, N. H., has announced a new line of gap type hydraulic presses which includes 4-, 6-, and 8-ton sizes. Cast construction of Meehanite metal and exceptionally rigid, well ribbed box type design are employed to reduce vibration and deflection to a minimum and to prevent the new presses from taking a permanent "set" from overloading or fatigue.

On standard models, the ram is controlled by a foot-pedal or hand-lever. Pressure on the foot control or hand-lever will move the ram down under power, and when relieved, the ram will automatically return to the power stop position. The ram is equipped with a square control rod provided with positive stop-collars. The pump is driven by a standard motor with V-belts, the motor being mounted on an adjustable bracket to permit belt adjustment.

The speed can be controlled on the 4- and 6-ton machines within a range of approximately 20 to 300 inches a minute. A coolant pump and fittings for broaching, an electric latch type control for the ram, and provision for electric time lag of the ram for a timing out cycle are features of these machines. Safety dual hand control of the ram is obtained through two shrouded flush-mounted push-buttons. This arrangement makes it necessary for the operator to use both hands in order to keep the ram in motion.

The presses are equipped with direct-reading hydraulic gages mounted at eye level to indicate the pressure applied. The gages are equipped with a needle valve which can be used as a snubber or to shut off the gage entirely after the required power setting of the press has been made in order to lessen gage wear. 80

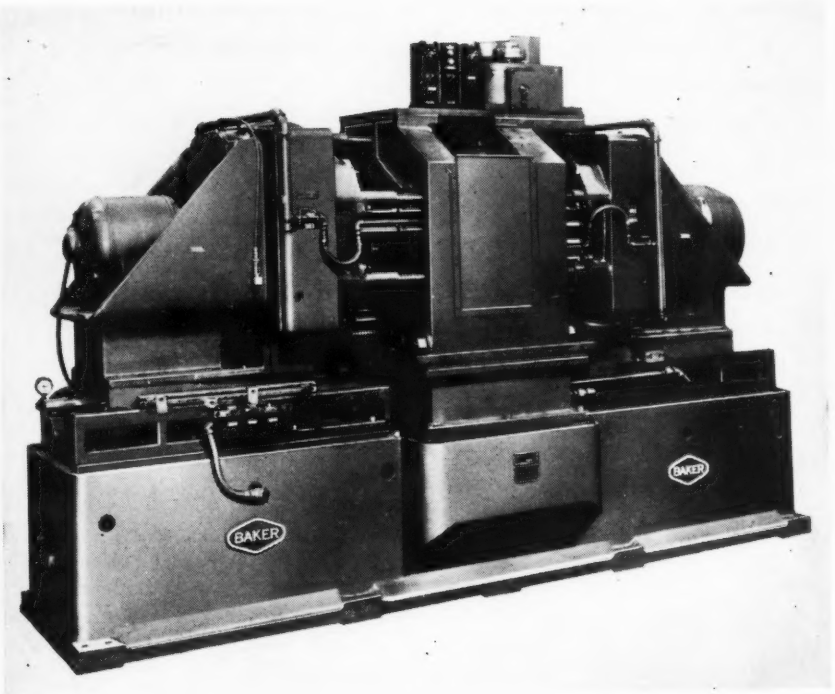
Baker Two-Way Connecting-Rod and Cap Finishing Machine

Baker Brothers, Inc., Toledo, Ohio, have recently developed a new two-way horizontal machine for the high-production machining of automobile-engine connecting-rods and caps. The new machine, of floor type construction, is furnished with a six-station trunnion type power indexing fixture arranged to clamp one connecting-rod and cap at each station, and utilizes two Baker 15 by 16 hydraulic feed saddle units. The saddles of these units are equipped with hardened-steel replaceable flat ways that allow a 16-inch travel. A positive depth stop and delayed reverse attachment can be included when desired.

The unit at the right of the machine illustrated is equipped with a twenty-spindle fixed-center multiple head, assembled with a self-contained lubricant pump, and is driven by a 10-H.P. motor. The unit at the left has a twelve-spindle head, and is driven by a 7 1/2-H.P. motor. Hydraulic power is provided for each of the saddle units by a completely separate variable-delivery portable pump-sump unit. 81

Westinghouse Electrodes

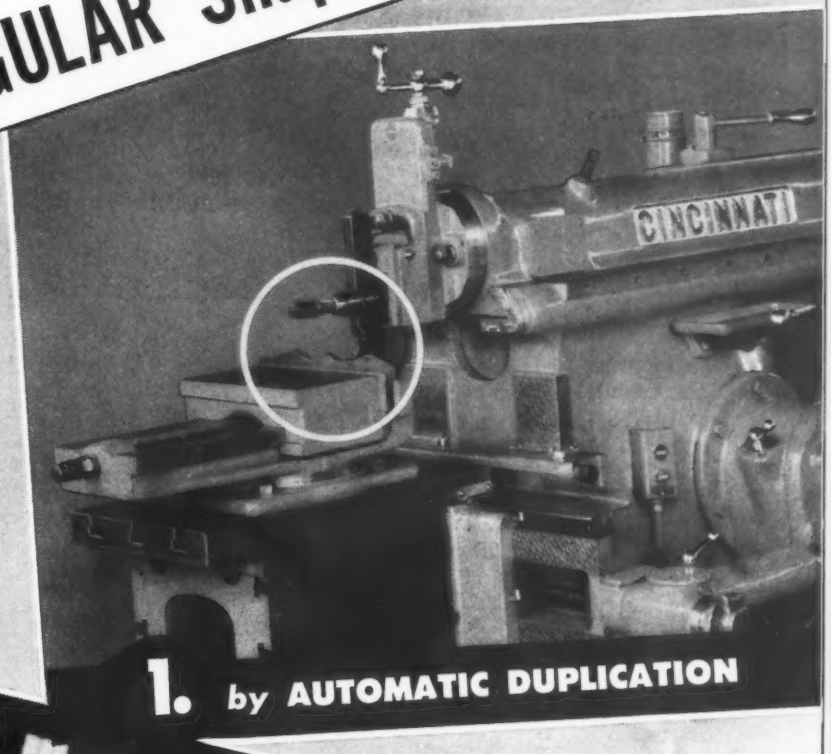
Two new "Flexarc" electrodes for direct- or alternating-current welding of cast iron have been announced by the Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. These electrodes, designated as "Castingweld" and "Freemachineweld," have been developed to hold thermal stresses to a minimum and to prevent extreme hardness in the heat-affected zone.



Two-way Horizontal Machine for Processing Automotive-engine Connecting-rods and Caps Developed by Baker Brothers, Inc.

To obtain additional information on equipment described on this page, see lower part of page 222.

Contouring IRREGULAR Shapes



1. by AUTOMATIC DUPLICATION

2. by MANUAL CONTROL

Cincinnati Shapers contour irregular shapes —economically—whether in the tool room or in the manufacturing plant.

① Where production is desired, costs are reduced by accurate automatic duplication.

② A unit or small lot is economically produced by manual control

Accurate, sensitive, vertical and front controlled cross feeds and the overall accuracy of a Cincinnati Shaper enable the operator to work to very close limits.

Write for information on contouring irregular shapes on a Cincinnati Shaper, the handy man of tool rooms and shops.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

The "Castingweld" electrode has a mild steel core wire and a special low melting point coating developed to overcome difficulties with entrapped slag, so frequently encountered in cast iron welding. This electrode is available in 3/32-, 1/8-, and 5/32-inch diameter sizes.

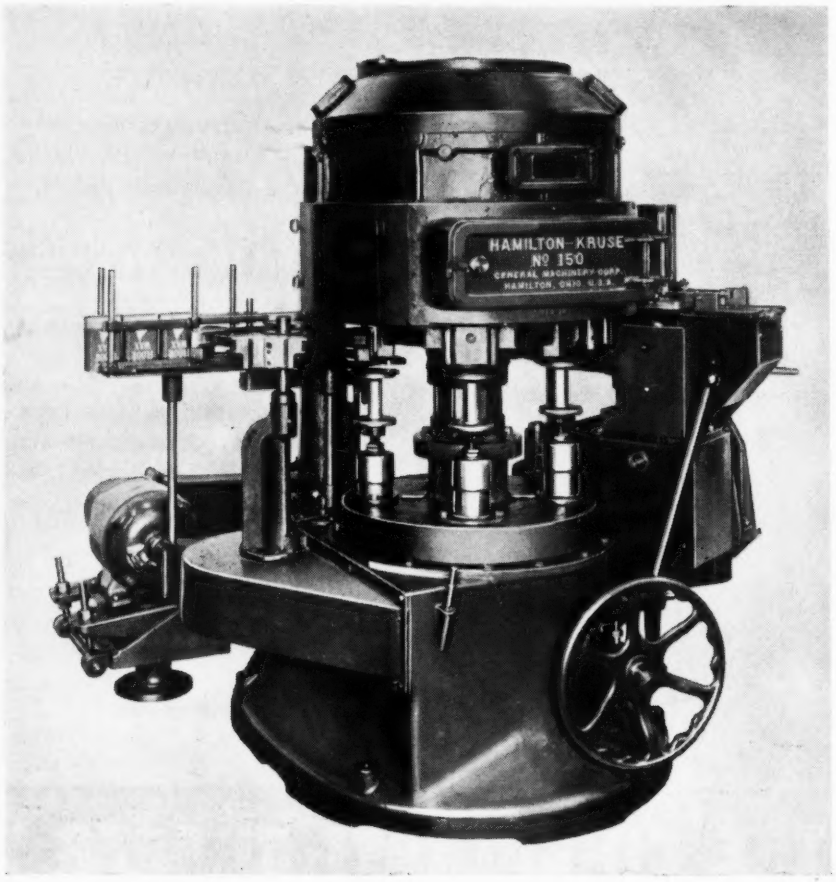
"Freemachineweld" electrodes have a pure nickel core wire, and are extruded with a special coating adapted for use on cast iron. The nickel core wire assists in controlling the welding stresses, as the melting temperature of nickel is relatively low and its expansion and contraction more closely match those of cast iron. The weld produced with this electrode is comparatively soft and readily machinable. This electrode is available in 1/8- and 5/32-inch diameters. 82

Hamilton-Kruse Automatic Seamer

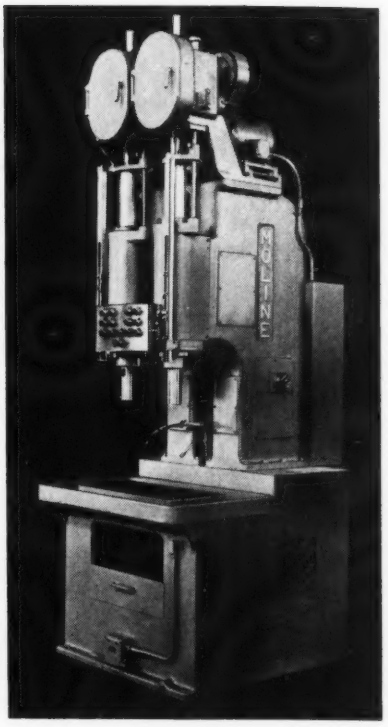
A high-speed automatic end seamer for square and irregular-shaped metal cans or containers, which is said to be the first machine of its kind offered for general sale, has been announced by the Lima-Hamilton Corporation, 60 E. 42nd St., New York 17, N. Y. This machine, designed by Peter Kruse, is being built by the Hooven, Owens, Rentschler Co. Division of the Lima-Hamilton Corporation, Hamilton, Ohio.

This is a completely automatic four-head unit with four round rollers on each head. With this Model 150 machine, the cans remain stationary on the baseplates during the seaming operations. The machine is equipped with automatic body and end feeds, a complete set of seaming parts, and its own motor and control.

The machine is driven by a 3-H.P. motor, requires a floor space of 72 by 82 inches, has an over-all height of 74 inches, and weighs 8300 pounds. It has a capacity for seaming cans 2 3/4 to 4 1/2 inches long, 1 3/8 to 2 5/16 inches wide, 2 13/16 to 4 3/4 inches across corners, and 2 to 11 inches high. The production is 150 cans per minute.....83



Hamilton-Kruse Automatic High-speed End Seamer for Square and Irregular-shaped Cans



Moline Two-spindle, Two-column Drilling Machine with Electrically Controlled Hydraulic Feed

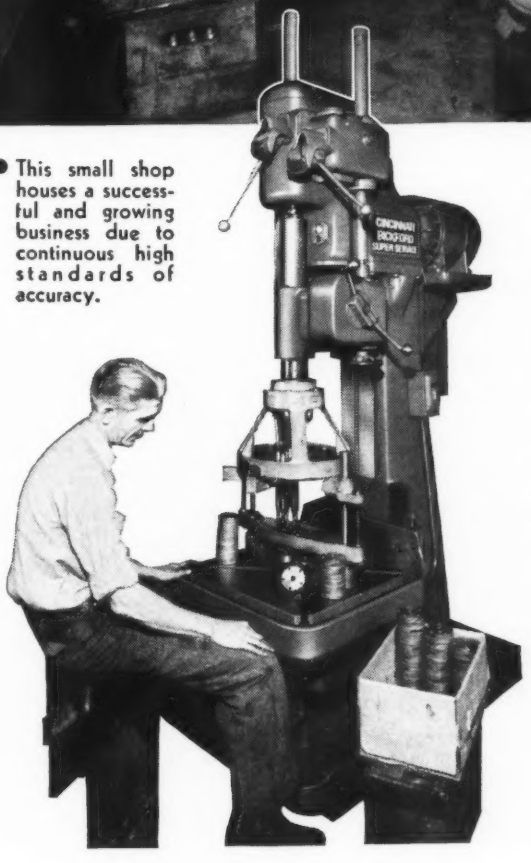
Moline Drilling Machine

A two-column drilling machine with individually controlled hydraulic feed to each of the two spindles is a recent development of the Moline Tool Co., 100 Twentieth St., Moline, Ill. This machine can be built in single-column, single-spindle or multiple-column, multiple-spindle styles. The spindle has a capacity for driving a 1 1/8-inch drill in mild steel. The new machine is designed for handling a wide variety of miscellaneous drilling and reaming jobs, but can be used as a continuous production machine when fitted with fixtures.

Electrical control of the hydraulic feed provides for an independent automatic operating cycle for each spindle, which can be initiated by a push-button or a foot-operated switch. Selector switches in the push-button station can be set so that either spindle will repeat the feed cycle continuously until stopped by the operator. In the two-column model, the spindles can be run in alternate, continuously repeating cycles by means of electrical interlocking controls. Thus, while one spindle is drilling, the other is in the "up" position, permitting the operator to reload the fixture. 84

To obtain additional information on equipment described on this page, see lower part of page 222.

4-Man Shop with a FUTURE



● This small shop houses a successful and growing business due to continuous high standards of accuracy.

Quality equipment pays the small operator as well as the large.

The Schoening Machine Service, 3284 Dunn Street, Cincinnati, Ohio—business, production machining—small in size—big in accomplishment—testifies to the value of fine tools.

The Cincinnati Bickford Super Service Upright Drill, illustrated, is drilling five $\frac{11}{32}$″ holes and four $\frac{11}{32}$″ holes to a plus or minus .005″ tolerance in a steel cover $\frac{5}{16}$″ thick—a production job.

Mr. Schoening tells us he has held accuracy to a plus or minus .0002″ on production reaming jobs.

Write for Bulletin No. U-25.

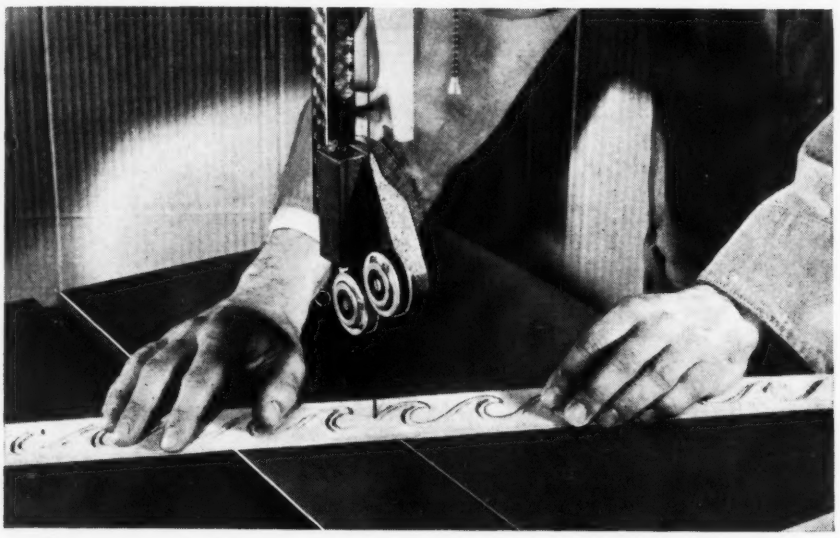
THE CINCINNATI BICKFORD TOOL CO.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Radials 7½″ dia. col., 2½′ arm, to 26″ dia. col., 12′ arm.
General purpose Uprights, 21″ to 28″ sizes.
Production Uprights, 21″ to 28″.
Jig Borers, Portable Horizontals, Spacing Table Machines.

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.



Spiral-edge Band Saw Placed on the Market by DoAll Co.

DoAll 360-Degree Spiral-Edge Band Saw

A new achievement in band-sawing operations centers around the development of a spiral or helical saw band recently announced by the DoAll Co., Des Plaines, Ill. This new saw has a hard cutting edge that spirals around the band, so that it can be used to cut in any direction without rotating the work. The application of the saw and the new type rubber-roller saw guides to a band-sawing machine greatly increases its versatility.

The hard tooth spiral permits the cutting of intricate dies. The saw can also be used for filing small radii in openings that are inaccessible to an ordinary bench file or needle file. The saws are available in two sizes—0.040 inch and 0.074 inch in diameter with a 15-tooth pitch. They are made in two types, a spring-tempered type for working plastic, wood, etc., and a hard-edge type for cutting metals. For internal sawing operations, the ends of the blade can be easily joined by conventional butt-welders. The saw is available in cut lengths or in coils of 100 feet. 85

Munton Motorized Hydraulic and High-Speed Air-Operated Presses

A new line of low-priced motorized hydraulic presses with capacities of 3, 5, 7, 10, and 25 tons, which can be used for straightening, forming, forcing in bushings and studs, and similar jobs, is offered to the trade by the Munton Mfg. Co., 9400 Belmont Ave., Franklin Park, Ill. These presses have been designed to eliminate many hand operations in manufacturing plants, maintenance departments, and welding and automobile body shops. They can be operated on current taken from a light socket.

Simply pushing a button causes the piston to descend and hold its pressure. Pressing a release pedal serves to return the piston to its original position. The presses are equipped with a 1/3- or 1/2-H.P., 110-volt alternating-current, 60-cycle motor. They are available in either the gap or four-post type. The 3-ton gap type press has a 3-inch stroke, 3-inch throat, and 6-inch daylight capacity. The 10-ton gap type press illustrated has a 7 1/2-inch stroke, a 9-inch throat, and a daylight capacity of 19 inches.

Another new development of the company is a high-speed air-operated press designed to deliver 200 strokes per minute. This press has been developed for such applications as riveting, cutting leather and cloth, drawing light materials, forming, and a wide variety of operations on products requiring light, fast work.

The new air presses are available in capacities of 1/2, 1, and 2 tons at 80 pounds air-line pressure. They are of all-welded construction, and designed with ample provision for overloads. Characteristics include two-way cylinders with cushioned top and bottom, and a ram guide which is manually operated.

The press can be readily mounted for use on any bench where connection with a compressed air-line is available. 86

Die Slick Lubricating Compound

A new lubricating compound designated "Die Slick No. 4," developed primarily for lubricating piston, ram, or plunger on cold-chamber die-casting machines, is being manufactured by G. W. Smith & Sons, Inc., 5400 Kemp Road, Dayton 3, Ohio. This compound can also be used for lubricating ejector and guide pins on pressure and die-casting dies and for use on all movable parts of permanent molds.

Being highly viscous, this compound is generally applied with a brush or swab, but can be spread on when necessary. Having extremely high heat resistance, it prevents all scoring or sticking of

Motorized Hydraulic Press Built by the Munton Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 222.

Stamper's Presses are BLISS

Selection of the right press for the specific job is made only after careful study and recommendations by the Bliss engineering staff, according to this plant's press-room superintendent. It is this ever-expanding fund of knowledge, over 90 years in the making, that has made Bliss the first choice of stampers the world over. "Ranking next in importance," he says, "is Bliss' prompt service when parts have to be replaced or the presses serviced."

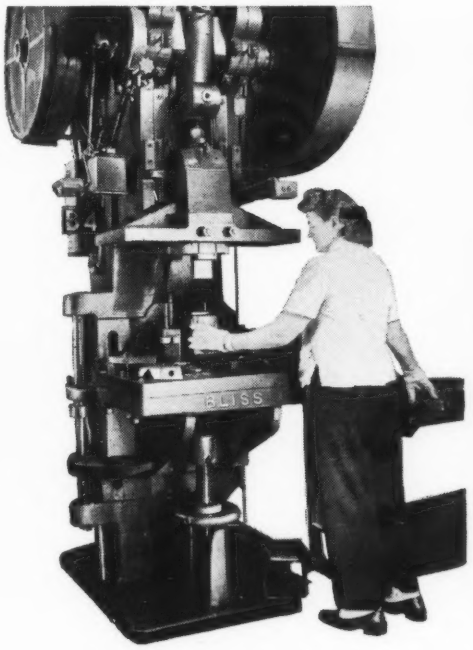
It's another reason why the pressed metal industry knows that Bliss on a Press Is More Than a Name—It's a Guarantee!...why it pays *you* to put your press problem up to Bliss.

E. W. BLISS COMPANY, DETROIT 2, MICHIGAN

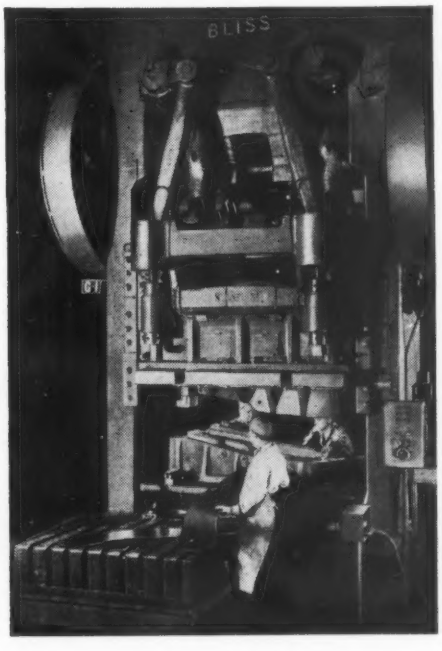
Mechanical and Hydraulic Presses, Rolling Mills, Container Machinery

WORKS AT: Toledo, Cleveland, Salem, Ohio; Hastings, Mich.; Englewood, N. J.; Derby, England; St. Ouen sur Seine, France • SALES OFFICES AT: Detroit, Hastings, Mich.; New York, Rochester, N. Y.; Cleveland, Dayton, Toledo, Salem, Ohio; Philadelphia, Pittsburgh, Pa.; Chicago, Ill.; New Haven, Conn.; Windsor, Ont.

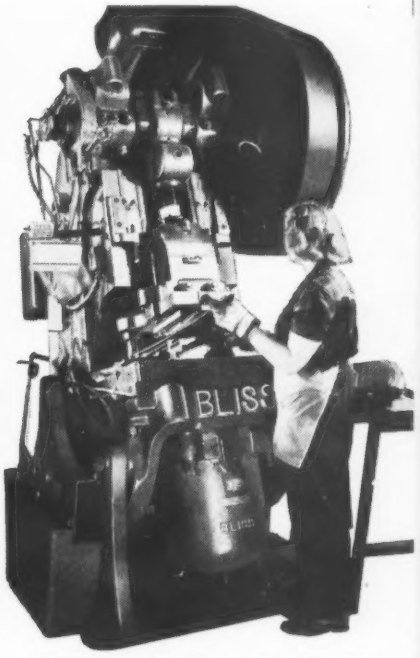
Trimming the turret top in a 4-point enclosed single action press with 160" wide bed. Press has 650 tons capacity. Operation is by electric push-button. Operators simply load and unload.



A Bliss adjustable bed press of 40 tons capacity is shown being used for general punch press work.



Deep pillars are drawn in Bliss No. 795½ Toggle Press. "The finest drawing press on the market," according to the pressroom superintendent.



Blanking salvaged scrap steel in No. 21½ Inclinable Press. Die cushion in bed permits shallow drawing.

BLISS BUILDS MORE TYPES AND SIZES OF PRESSES THAN ANY OTHER COMPANY.

STAY AHEAD WITH *Bliss*

parts on which it is coated. It contains no fats or heavy carbonizing materials, causes no "gumming," will not become rancid, and produces no objectionable smoke or gases. 87

Machine for Testing Automotive Cylinder-Head Volume

A special machine has been designed by the Synder Tool & Engineering Co., 3200 E. Lafayette, Detroit, Mich., for testing the volume of automotive cylinder heads after machining operations.

The cylinder-head unit is first clamped in the fixture by air-operated toe clamps which engage the four corners of the part, and by a latch type clamp which is manually positioned and clamped over the center of the part. The operator then opens a valve which causes the series of metering glasses along the top of the machine to be filled with a compound-treated water. Each glass is then opened, allowing the liquid to pass into the cylinder-head combustion chambers. This liquid-rising in the glass gages, registers the volumetric content of each combustion chamber.

Because air bubbles remaining inside the head would give an appreciably inaccurate reading, the liquid is brought into the combustion chambers in such a way that all air is displaced. At the completion of the metering cycle, the liquid is drained into a tank and pumped up to a reservoir above the metering glasses. The machine can be operated by an unskilled worker. The production rate is sixty pieces an hour.....88

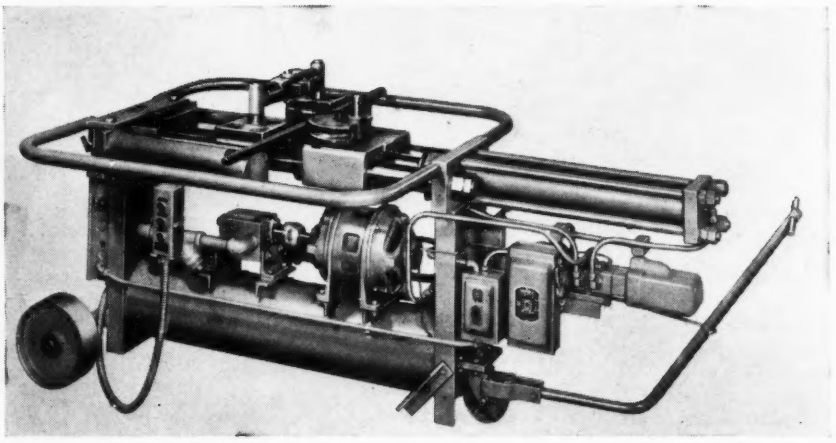
Snyder Machine for Testing Volume of Automotive Cylinder Heads

Magnetic Base for Dial Indicator

The du Mont Corporation, Greenfield, Mass., has recently added to its line a "Minute Man" magnetic base consisting of an Alnico permanent-magnet base having a 40- to 50-pound grip on all four sides. Interchangeable brass shafts, 7/32 and 5/16 inch in diameter, are provided for readily attaching any dial indicator gage or height gage to the base. The magnetic base is also available complete with a Federal dial gage, graduated to 0.001 inch, enclosed in a hard wood case.

This device permits instant application of the gage at the most convenient and desirable spot on lathes, millers, surface and cylindrical grinders, shapers, planers, and other machine tools. No clamps or special attachments are needed, and the gage is accurately and firmly positioned, even in places otherwise inaccessible.

In addition to dial-gage applications, the magnetic base has many other uses around the shop. It can be used for holding work in position on surface plates when making lay-outs; supplying magnetic power to rods for removing chips from drilled or tapped holes; and holding the nozzles of coolant pipes on machine tools. Shaft socket holes are tapped for 12–24 threads to accommodate special-length shafts. 89



Wallace Portable Hydraulic Ram Type Bending Machine

Wallace Portable Ram Type Bending Machine

The Wallace Supplies Mfg. Co., 1308 W. Diversey Parkway, Chicago 14, Ill., has added a portable hydraulic ram type bending machine to its line of bending equipment. This machine employs a simplified method of bending that requires no repositioning of the dies or relocating of the pipe when making bends up to 180 degrees in one continuous operation.

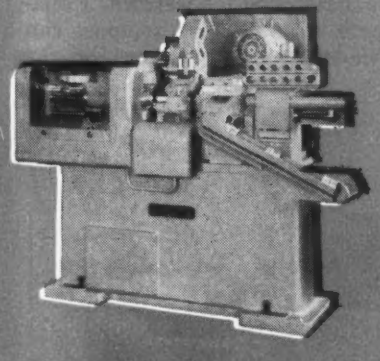
The bending machine is furnished with standard die equipment for bending up to 2-inch extra heavy weight steel pipe. Special dies are available for bending angles, channels, reinforcing bars, flat bars, and similar work. The new machine is adapted for

"Minute Man" Magnetic Base with Dial Indicator

To obtain additional information on equipment described on this page, see lower part of page 222.

EX-CELL-O
CAN GIVE YOU *Economical* PRODUCTION

Above: Wrist pin holes of aluminum alloy pistons are rough and finished precision bored on the Ex-Cell-O Automatic Piston Boring Machine shown below.



Above: Ex-Cell-O Automatic Piston Boring Machine. Chute at front delivers finished work to conveyor at rate of 200 pistons per hour net.

48-16

Ex-Cell-O Piston Boring Machines Cut Unit Costs with Fully Automatic Operation

One solution to the problem of rising labor and material costs is through the use of more automatic machinery. For instance, the Ex-Cell-O Piston Boring Machine shown to the left provides an excellent illustration of how automatic operation increases output per manhour. The pistons are fed into the machine from a chute, and after being rough and finish bored they are ejected onto a conveyor belt *at a rate of 200 pistons per hour net!* Pistons come to the machine with the wrist pin holes just as they are cast—no previous operations on them are necessary. The operator's only function is to load the work into the chute and spot check the finished parts. In many instances, one man can take care of several machines.

XLO
EX-CELL-O for PRECISION

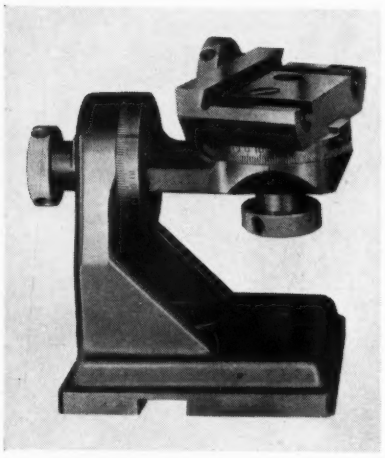
EX-CELL-O
CORPORATION
DETROIT 6, MICHIGAN

Special Multiple Way-Type Precision Boring Machines • Special Multiple Precision Drilling Machines • Precision Boring, Turning, and Facing Machines, and Fixtures • Precision Cylinder Boring Machines • Precision Thread Grinding Machines • Precision Lapping Machines • Precision Broach Sharpening Machines • Other Special Purpose Machines • Tool Grinders • Continental Cutting Tools • Broaches, Broach Fixtures and Broach Grinders • Counterbore Sets • Grinding Spindles • Hydraulic Power Units • Textile Spindles • Drill Jig Bushings • R.R. Pins and Bushings • Fuel Injection Equipment • Dairy Equipment • Aircraft and Miscellaneous Production Parts

construction work, radiant heating, and other applications. Push-button control is provided. A jog button facilitates setting up and accurate duplication of special parts formed to templets. 90

Landis Chaser-Grinding Attachment

The Landis Machine Co., Waynesboro, Pa., has announced a new chaser grinding fixture designed to provide an inexpensive, satis-



Attachment Developed for Grinding Landis Chasers

factory method of grinding Landis chasers. It is intended that this fixture be used to grind, on the "tangential" chaser, the compound rake and lead angles which are essential to the production of accurate, well formed threads. A cross-arm, supported by the base casting of the attachment, is so arranged that the chaser platen can be adjusted vertically. This feature makes possible the grinding of any desired rake angle.

The platen can be rotated throughout a 360-degree circle horizontally, thus providing an accurate means of producing the desired lead angle. Knurled knobs, which have pin-holes to provide for added leverage, securely hold the fixture in the position in which it is set. The attachment can be readily adapted for use on any grinding machine that has a traversing table, regardless of the type of wheel used. The base of the fixture is so made that it can be clamped to a table having a T-slot or to a magnetic chuck. The fixture can be used on Landis chasers of all widths up to 1 1/4 inches. It is 3 1/4 inches square at the base, and has a height of 3 15/16 inches. 91

Gairing Improved "E-Con-O-Mill"

The Gairing Tool Co., 21225 Hoover Road, Detroit 32, Mich., has made several improvements in the "E-Con-O-Mill" cone type face milling cutter described and illustrated in January MACHINERY, page 218. The carbide tips on the square tool bit type blades have been increased from 3/8 to 5/8 inch in width, so that they now extend the full width of the blade.

The blades, furnished with all clearance angles finish-ground, are protected by a plastic coating

Improved E-Con-O-Mill Face Milling Cutter

and packed in individual cartons. The three types of blades now available for cutting various metals are identified by different colors. An assembly fixture is provided as additional equipment, which accommodates all sizes of cutters and makes possible fast and accurate assembly of the blades in the cutter bodies. 92

R and L Cutting-Off Tool-Holders and Special Cutting-Off Blades

A new line of holders for cutting-off blades, designed as shown in Fig. 1, and a toolpost developed to facilitate quick, accurate mounting of these holders, as illustrated in Fig. 2, have been announced by R and L Tools, 1825 Bristol St., Nicetown, Philadelphia 40, Pa. The toolpost can be mounted on the front or the

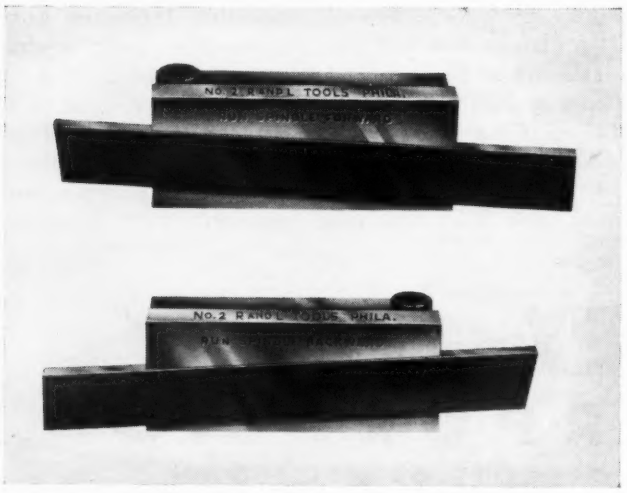


Fig. 1. R and L Cutting-off Tool-holders Designed for Quick, Accurate Mounting in the Toolpost Shown in Fig. 2

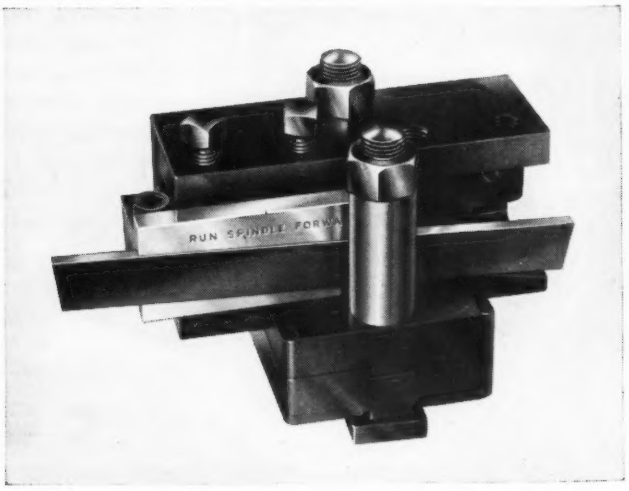


Fig. 2. R and L Toolpost for Front- or Rear-slide Mounting of Tool-holders and Blades Such as Shown in Fig. 1

To obtain additional information on equipment described on this page, see lower part of page 222.

TAPS produced by the Sheffield corporation

Yes . . . for highest tap quality and lowest threading costs . . . you can *now* specify SHEFFIELD H. S. Ground Taps.

Technical developments in Sheffield's Research Division, based on nearly half a century of threading experience, constitute the heritage of Sheffield Taps.

Quietly . . . and under close supervision . . . Sheffield Taps have been tested by use in many of the nation's leading high production plants over the past two years.

NOW IT CAN BE TOLD — *More* and *better* threads are being produced per dollar of tool cost on practically every job where Sheffield Taps are used.

Why not cut *your* threading costs, too. Write for *your* copy of Sheffield's 64-page Tap Data Handbook. 2908

Standard Taps
Shipped From Stock

Prompt Attention to Specials

Adequate Field Engineering
Service for Tough Jobs

Sold by
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Standardize on Sheffield
Taps and Thread Gages

Dayton 1, Ohio, U. S. A.

MASTER CRAFTSMEN SHEFFIELD HEADQUARTERS

Gages, Measuring Instruments, Machine Tools, Contract Services and Threading Tools.

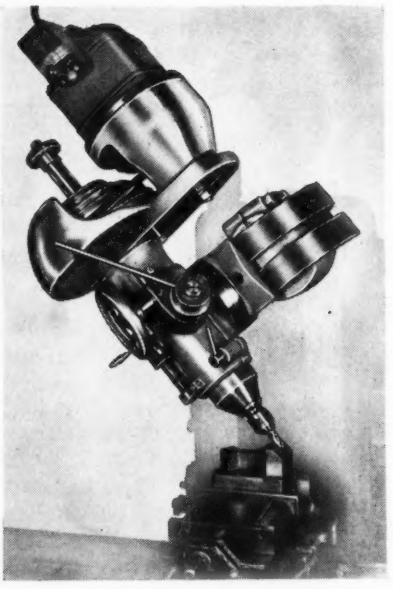
back cross-slide of an automatic lathe or screw machine to permit cutting-off work with the lathe spindle running in either the forward or backward direction.

The cutting-off blades are made of special alloy high-speed steel. Blades of tungsten carbide can also be furnished if desired.....93

Roll Spreaders for Applying Drawing Compound

The Union Tool Corporation, 310-316 E. Market St., Warsaw, Ind., is manufacturing motor-driven roll-type spreaders which provide an economical means for applying coatings of drawing compound to metal sheets or coiled stock in preparation for pressing, forming, or drawing operations. The spreaders are so designed that any desired thickness of coating can be applied to either the top or bottom or both sides of the sheet.

The spreaders will handle any flat material that needs to be coated, including metal, wood, paper, etc. Viscous coatings of many kinds can be applied, in addition to drawing compounds. Standard models of these machines handle sheets ranging from 18 to 102 inches in width. Sheets of material varying from 0 to 2 inches in thickness can be handled by turning a regulating wheel. 94



Rusnok Milling Head with New Type Mounting Bracket

"Rail Type" Bracket Mounting for Rusnok Milling Head

The Rusnok Tool Works, 4840 W. North Ave., Chicago 39, Ill., has brought out a new rail type mounting for its milling attachment, which is designed to make this combination of equipment fully universal. The milling attachment, when mounted with the rail type bracket as shown in the illustration, can be positioned for operation on either side of the over-arm. Thus the milling attachment can be quickly and easily placed and rigidly locked in any position within a full 180-degree adjustment range.

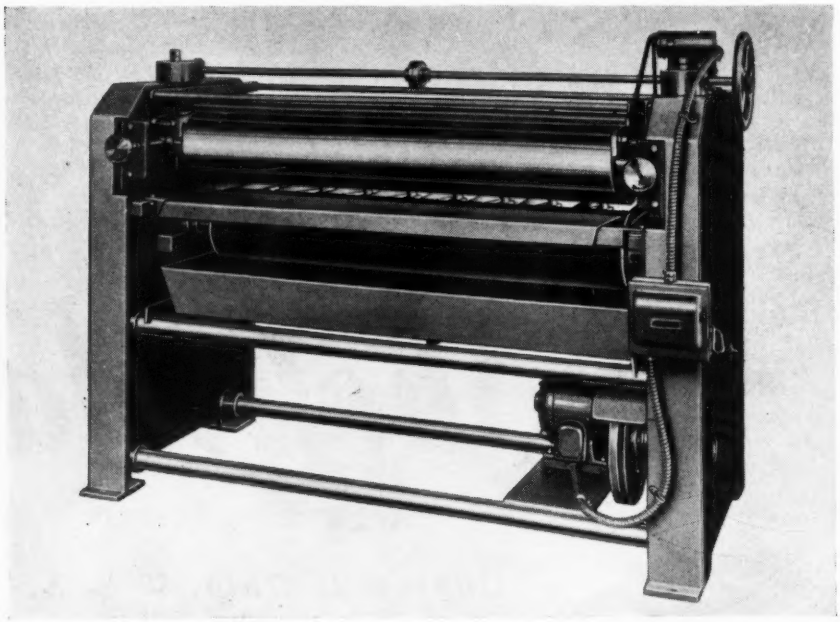
The new rail type brackets can be fitted to milling machines with round over-arms ranging in size from 3 to 5 inches in diameter. They are easily adaptable to any old or new Rusnok milling attachment. 95

Try-Out Press for Testing Dies

A die-testing try-out press, which can be installed in the die shop on a bench or on its own fabricated stand, has been brought out by the General Mfg. Co., 6430 Farnsworth Ave., Detroit 11, Mich. This eliminates the need for trying out dies on the production press.

Press for Trying out or Testing Dies in the Die Shop Brought out by the General Mfg. Co.

A heavy, large-diameter handwheel, operating in combination with a fast-lead thread on the ram, permits the punch to be safely moved in and out of the die at the rate of 1.6 inches per revolution of the wheel. By whirling the large wheel, it is possible to obtain a percussion pressure of 60,000 pounds for use in making test pieces after the die has been completed. 96

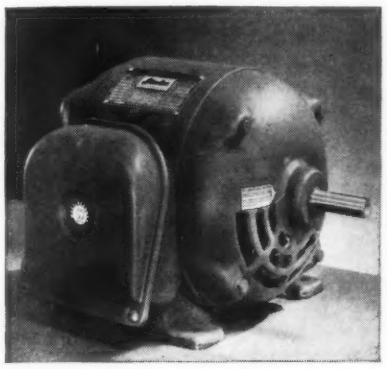


Union Power-driven Spreader for Applying Coatings of Drawing Compounds or Adhesives to Flat Sheet Material

To obtain additional information on equipment described on this page, see lower part of page 222.

Westinghouse Single-Phase Squirrel-Cage Motor

A single-phase "Life-Line" capacitor-start, induction-run, squirrel-cage motor is available from the Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa., in ratings of 3/4, 1, 1 1/2, 2, 3, 5, and 7 1/2 H.P. This motor is of all-steel construction with steel frame, feet, and end brackets. It utilizes the capacitor for starting only. The starting switch or relay disconnects the capacitor as the motor approaches full speed, after which



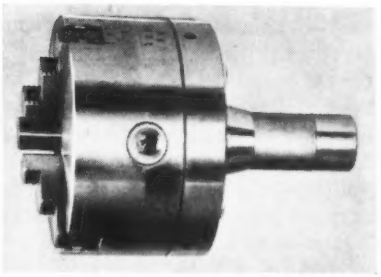
Westinghouse "Life-Line" Motor

it operates as an induction motor. These motors can be used for practically any single-phase application, including the driving of machine tools, compressors, air conditioners, and reciprocating or centrifugal pumps. They are available for operation on a variety of electrical supply lines...97

Chuck for D-S Grinder

The D-S Grinder Division of Royal Oak Tool & Machine Co., Royal Oak, Mich., has announced a new chuck for use with the fixture of the company's radial relief grinder. This chuck has a capacity of 1/8 inch to 5 inches. It is mounted on a faceplate equipped with a ground arbor that fits the fixture spindle. Adjustment can be made between the chuck and the faceplate to assure positive concentricity of the chuck.

The chuck can be used to advantage in place of collets in job shops where one or two tools of a size are relieved at a time, since it eliminates loss of time in changing collets. It does not replace collets, however, both chucks



Chuck for D-S Grinder Brought out by the Royal Oak Tool & Machine Co.

and collets being supplied as accessories for the grinder. The new chuck is of the three-jaw type, and is furnished with an extra set of jaws and wrench. 98

Scherr Vernier Caliper

The George Scherr Co., 200 Lafayette St., New York 12, N. Y., announces a rustless chrome vernier caliper designed to enable a mechanic or toolmaker to make outside, inside, and depth measurements from 0 to 6 inches in increments of 0.001 and 1/64 inch. The caliper is provided with knife-edges for measuring the root diameter of threads, and with points that are designed for accurate dividing operations.

All parts are manufactured to extremely close tolerances, so that the sliding action is very smooth when the vernier is moved along the scale. The blades and jaws of the tool are hardened throughout. The graduations are extremely fine, and the jaws have an optically lapped finish. When checked with optical flats, the measuring surfaces are found to be accurate within eight millionths of an inch. The jaws are also guaranteed to be parallel to each other. This tool is being manufactured in Switzerland for the George Scherr Co. In addition to the English scale model, there is available a model graduated in both English and metric systems, with the vernier reading to 1/1000 and 1/20 millimeter. 99

Sundstrand Constant-Volume Pump

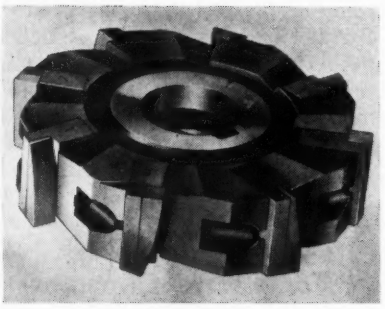
The Sundstrand Machine Tool Co., Hydraulic Division, Rockford, Ill., has added to its line of hydraulic equipment a low-cost con-

Sundstrand Hydraulic Pump

stant-volume pump designed for quiet operation at a pressure of 1000 pounds per square inch. This pump is made in eight different capacities ranging from 3 to 10 gallons per minute at an operating speed of 1200 R.P.M., and can be employed for operating materials-handling equipment, industrial heating units, and similar applications. The Model 5-W pump is suitable for direct-coupling drives only. Other models can be furnished when a sheave or pulley type drive is required. 100

Scherr Rustless Chrome Vernier Caliper

To obtain additional information on equipment described on this page, see lower part of page 222.



Aber Carbide-tipped Curved-tooth Milling Cutter

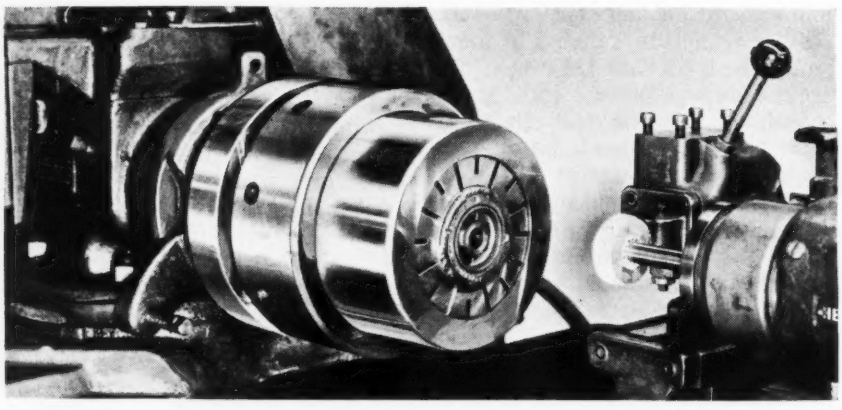
Carbide-Tipped Cutter

The Aber Engineering Works, Inc., Waterford, Wis., has announced a new development in its line of curved-tooth milling cutters, consisting of the addition of carbide tips. The new cutters combine the unique Aber curved-tooth design with the metal removing characteristics of carbide.

The curved-tooth shearing action of this cutter serves to counteract the inherent brittleness of carbide and to reduce the power required for the machining operations, as well as to eliminate chatter. Cutters over 1 inch in width are equipped with inserted carbide blades, while those under 1 inch in width are furnished with brazed-in carbide blades. 101

Erickson Pull Chuck

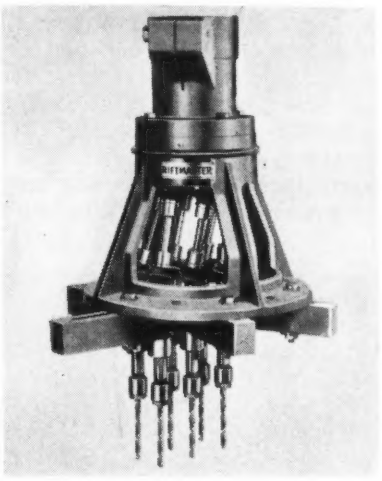
A Model 901 pull chuck has been added to the line of chucks made by Erickson Tools Division, 2309 Hamilton Ave., Cleveland 14, Ohio. This new chuck is designed to be operated by means of the standard draw-bar mechanism of the machine. It provides a rapid means for changing parts on which precision grinding operations are performed. The chuck has a capacity range of 5 3/4 to 3 7/8 inches, adjustable in increments of 1/32 inch. 102



Erickson Chuck Designed for Operation by Standard Draw-bar Mechanism

Adjustable Multiple-Spindle Drill Head

The Thriftmaster Products Corporation, Lancaster, Pa., has recently added a new model to its line of adjustable multiple-spindle



Thriftmaster Adjustable Multiple-spindle Drill Head

drill heads. This drill head is of the universal joint type, and is ball-bearing mounted. Unusually strong construction and flexibility of operation are outstanding features of this drill head. It has a high overload capacity, is made for use with power feed, and has a rated capacity for drilling 1/4-inch holes in steel.

The drill head can be furnished with two to six spindles having a minimum center spacing of 1 1/8 inches within a circle 6 1/4 inches in diameter. 103

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in April, 1948, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

NAME..... POSITION OR TITLE.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

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New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 228 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the April, 1948, Number of MACHINERY

Ball and Roller Bearing Data

HOOVER BALL & BEARING CO., Ann Arbor, Mich., is publishing a house organ known as "The Hoover Sphere," which contains information to users and possible users of balls and ball and roller bearings, as well as material of general interest. Engineering and purchasing executives may have their names placed on the mailing list if they send a request on their firm's stationery, addressed directly to the Hoover Ball & Bearing Co.

Oiler Wall Chart

GITS BROTHERS MFG. CO., 1830 S. Kilbourn Ave., Chicago 23, Ill. Wall chart illustrating 142 of the company's oilers, oil and grease seals, and other lubricating devices. Engineers, designers, and buyers of equipment using lubricating devices may obtain this wall chart by writing directly to the company, attention Frank A. Kovarik, general sales manager.

Mold Bases for Plastic and Metal Die-Casting

DETROIT MOLD ENGINEERING CO., 6686 E. McNichols Road, Detroit 12, Mich. Catalogue containing 152 pages of data covering the company's complete line of standard mold bases for plastics and metal die-casting. Copies can be obtained by addressing a request on a company letter-head to Detroit Mold Engineering Co.

Trucks and Tractors

MERCURY MFG. CO., 4044 S. Halstead St., Chicago 9, Ill. Catalogue 7-11, containing 52 pages of data on the Mercury complete material-handling line, including fork trucks, lift-trucks, tractors, and trailers. Copies will be sent to those requesting them on a company letter-head addressed to the Mercury Mfg. Co.

Magnetic Analysis

DINGS MAGNETIC SEPARATOR CO., 4740 W. McGeogh Ave., Milwaukee 14, Wis. Bulletin 1120, describing the company's magnetic research laboratory which analyzes materials, without charge, to determine how they can best be magnetically separated, and gives recommendations for handling separation problems. 1

Speed Indicating Instruments

O. ZERNICKOW CO., 15 Park Row, New York 7, N. Y. Circular containing data on the O-Z improved direct-reading tachoscope, a non-magnetic chronometer and speed indicator, combined in one unit. Also described is the O-Z improved tachoscope designed to serve as a test standard for shop and laboratory use. 2

Sheet-Metal Fabricating Service

COLGATE MFG. CORPORATION, South Bayview Ave., Amityville, Long Island, N. Y. Bulletin describing the engineering, tooling, and production sheet-metal fabricating facilities offered by this company, which specializes in aluminum, magnesium, and stainless steel. 3

Materials-Handling Equipment

CLARK EQUIPMENT CO., TRUCTRACTOR DIVISION, Battle Creek 67, Mich. 40-page catalogue covering the Clark line of special handling attachments, including the latest models of gas and electric fork trucks and industrial towing tractors. 4

Welding for Reclamation and Hard-Facing

AMERICAN MANGANESE STEEL DIVISION, AMERICAN BRAKE SHOE CO., Chicago Heights, Ill. Bulletin 1047-W, describing how to keep equipment operating through conservation welding. Specifications are given for various Amsco rods and electrodes. 5

Carbide Tool Grinders

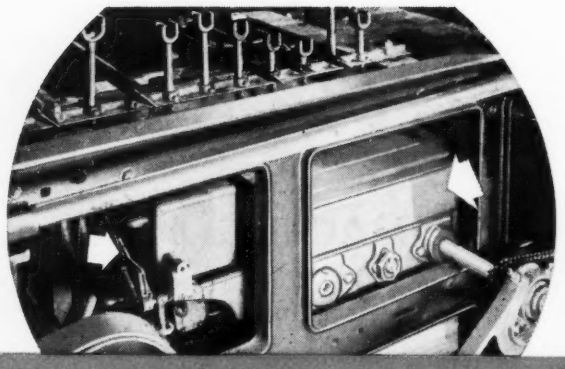
HAMMOND MACHINERY BUILDERS, INC., Department GP-14, Kalamazoo 54, Mich. Catalogue 220, illustrating and describing the company's complete line of wet and dry carbide tool grinders, chip-breaker tool grinders, and diamond tool grinders. 6

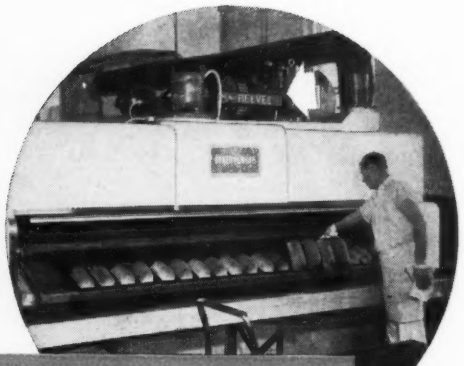
Welding Symbols

LINCOLN ELECTRIC CO., 12818 Coit Road, Cleveland 1, Ohio. Bulletin 458, entitled "Designer's Guide for Welded Construction," showing the standard symbols to be used in drawings or specifications to denote various types of welds.....7

Broaching Machines

OILGEAR CO., 1312 W. Bruce St., Milwaukee 4, Wis. Bulletin 22001 illustrating and describing the new vertical fluid-power Cyclematic broaching machines with automatic tool-handling, work-centralizing, and work-ejection features. 8

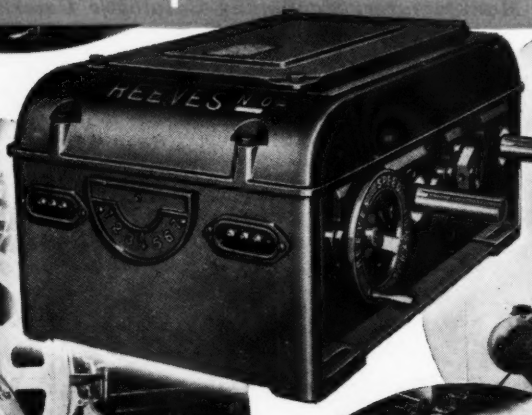


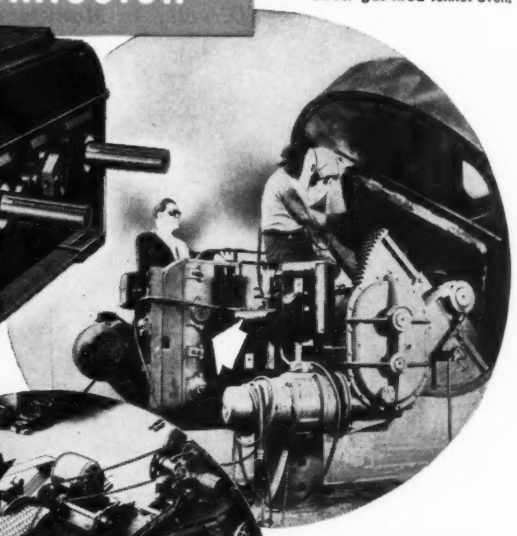


REEVES Variable Speed Transmission

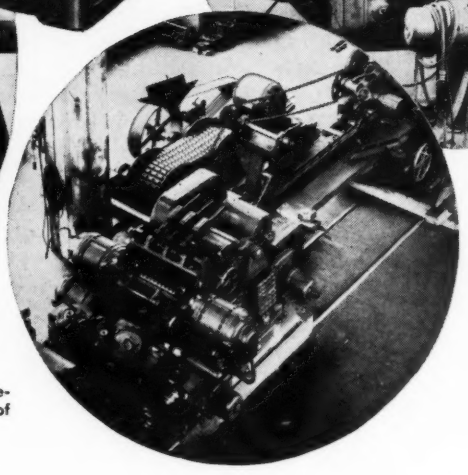
Above: Accurately controls baking time of bread in direct gas-fired tunnel oven.

Above: Maintains constant tension, reduces stretch of yarn on slasher in textile mill.





Above: Varies speed as required in filter processing of synthetic rubber.



Above: Regulates speed of rotary table on welding positioner, for continuous weld.

Left: Provides infinite speed adjustability on lumber planer and matcher.

Provides infinite, accurate speed flexibility within 2:1 to 16:1 ratio

Proved in thousands of installations in scores of industries, REEVES Variable Speed Transmission is the original compact and mechanically correct unit which drives production machines at infinitely variable speeds—making available instantly the most efficient speed for each different operation. It covers the entire speed range smoothly, without steps and without interrupting production . . . maintains any desired speed without fluctuation. Available in sizes fractional to 87 hp, both horizontal (illustrated) and vertical types, either open or enclosed designs. Choice of manual (handwheel), electric remote (push button) or entirely automatic controls.

Also in the complete line of REEVES Speed Control equipment are two other basic units—the Motodrive and the Vari-Speed Motor Pulley—likewise offered in the widest selection of designs, sizes, speed ratios and controls.

By providing the right speed for every job, under every changing condition, REEVES Speed Drives are assuring better quality products, higher rates of production and lower manufacturing costs in more than 260,000 widely diversified industrial installations and as standard equipment on more than 2,100 different makes of machines.

A REEVES engineer experienced in your field will be glad to consult with you. For information on the entire REEVES line, write today for the comprehensive 114-page catalog M-450A.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

ACCURATE • VARIABLE

Reeves Speed Control

GIVES THE RIGHT SPEED FOR EVERY JOB!

Electric Micrometer

STEVENS-ARNOLD, INC., 22 Elkins St., South Boston 27, Mass. Circular illustrating and describing the Stevens-Arnold electric micrometer suitable for measuring and gaging and for telemetering where remote indication of small movements is desired.....9

Electric Control Instruments

ELECTRO-TECH EQUIPMENT CO., 117 Lafayette St., New York 13, N. Y. Catalogue 48, containing 60 pages on electrical and electronic instruments and controls, including pyrometers, recorders, thermocouples, meters, counters, power transformers, etc. 10

Use of Beryllium Alloys

BERYLLIUM CORPORATION, Reading, Pa. Bulletin entitled "Health Experiences in the Fields of Manufacture and Use of Beryllium Alloys and Beryllium Compounds," prepared to correct misinformation on the toxicity effects of beryllium. 11

Measuring Bearing Quality

PHYSICISTS RESEARCH CO., 321 S. Main St., Ann Arbor, Mich. Leaflet illustrating and describing the Type BAA Anderometer, a mechanical-electronic instrument which gives an over-all quality rating of assembled ball bearings.....12

Weldability of Various Alloys

EUTECTIC WELDING ALLOYS CORPORATION, 40 Worth St., New York 13, N. Y. Booklet showing weldability of many commercial alloys; type of weld, equipment design, and application of special gas and arc welding rods are given.....13

Gears and Speed Reducers

OHIO GEAR CO., 1311 E. 179th St., Cleveland 10, Ohio. Catalogue 48, containing 120 pages listing stock gears, speed reducers, chain, and sprockets. Engineering data, tests, ratings, ratios, formulas, tables, and prices are included...14

Stop for Preventing Reverse Rotation

FALK CORPORATION, 3001 W. Canal St., Milwaukee 8, Wis. Bulletin 10,080, descriptive of a new backstop for preventing reverse rotation on conveyor drives.....15

Centerless Thread Grinder

LANDIS TOOL CO., Waynesboro, Pa. Bulletin CTG, describing the Landis centerless thread grinder. Condensed specifications are included. Catalogue T-47, describing the Landis No. 12 centerless grinder.....16

Internal Comparators

PRATT & WHITNEY DIVISION NILES-BEMENT-POND CO., West Hartford 1, Conn. Circular 499, containing specifications for the various models of Electrolimit internal comparators, and describing their applications. 17

Contour Turning Lathe

CINCINNATI LATHE & TOOL CO., Oakley, Cincinnati 9, Ohio. Folder describing the "Contourmatic Cintilathe" for the automatic turning of multiple-diameter shafts by means of a hydraulic tracer mechanism. 18

Heat-Treating Furnaces

AJAX ELECTRIC CO., INC., Frankford Ave. at Delaware Ave., Philadelphia 23, Pa. Bulletin 120, describing Ajax isothermal quench furnaces for "martempering," "austempering," and similar quenching operations. 19

Press Selection

VERSON ALLSTEEL PRESS CO., 1355 E. 93rd St., Chicago 19, Ill. Bulletin G-47, entitled "How to Select a Press," containing information of value in determining the type of press to use for specific job requirements. 20

Bronze Welding Electrodes

AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 4, Wis. Bulletin W-17, describing the extensive line of bronze welding electrodes made by the company and giving information on welding technique and procedures. 21

Roller-Chain Flexible Couplings

BALDWIN - DUCKWORTH DIVISION, CHAIN BELT CO., Springfield 2, Mass. Bulletin 48-6, describing the design, application, and selection of Baldwin-Rex roller-chain flexible couplings....22

Meehanite Metal

MEEHANITE METAL CORPORATION, Pershing Square Bldg., New Rochelle, N. Y. Bulletin 26, entitled "Formulas for Computing Maximum Stresses and Deflections in Circular Flat Plates Cast in Meehanite." 23

Boron Master Alloy

NORTON CO., Worcester 6, Mass. Folder describing the composition, purpose, and advantages of a chemically balanced alloy of boron and iron for adding boron to steel and cast iron. 24

Pipe Threads

EASTERN MACHINE SCREW CO., 23-43 Barclay St., New Haven 6, Conn. Publication entitled "Die Headlines," containing an article on "Dryseal" pipe threads for sealing pressure-tight joints.....25

Stainless Pipe and Tubing

A. B. MURRAY CO., INC., 616 Green Lane, Elizabeth, N. J. Bulletin listing stainless pipe and tubing, seamless mechanical tubing, and boiler tubes available for shipment from stock. 26

Wire-Working Machinery

DORE MFG. CO., INC., Grayling, Mich. Catalogue describing the construction of the Dore "Wiro-Matic" straightening and cut-off machine, and illustrating the various models. 27

Fastening Equipment

FABRISTEEL PRODUCTS, INC., 21500 Eight Mile Road West, Detroit 19, Mich. Circular describing the features of "Fast-On" clinch nuts and the "Fast-On" attaching machine. 28

V-Belt Drives

TRANSMISSION MACHINERY CORPORATION, P.O. Box 2135, Dallas, Tex. Catalogue 471, on Transco V-belt drives with combination groove sheaves. 29

Stud Welding

NELSON SALES CORPORATION, Toledo Ave. and E. 28th St., Lorain, Ohio, is publishing a house organ, issued bi-monthly, describing applications of the Nelson method of fastening.....30

Pipe and Stud Extractors

REPS TOOL CO., INC., Hartford, Conn. Leaflet describing the operation of Reps pipe and stud extractors, available either as

single units or as a complete set of ten tools. 31

Light-Duty Pillow Blocks

AHLBERG BEARING CO., 3025 W. 47th St., Chicago 32, Ill. Folder containing data and specification charts on "Economy Twin" ball-bearing pillow blocks for light-duty application. 32

Automatic Punch-Press Feed

COVERT MFG. CO., Troy, N. Y. Bulletin describing the "Feed-O-Matic," an automatic punch-press feed designed to increase production and eliminate hazards on secondary operations. 33

Clad Strip Steels

SUPERIOR STEEL CORPORATION, Carnegie, Pa. Bulletin on "Su-Veneer" clad metals, a low-carbon strip steel clad with solid copper, Monel, or nickel. 34

Radius Dressing Tool

J & S TOOL CO., INC., 477 Main St., East Orange, N. J. Bulletin illustrating and describing the "Form-Master," designed for angle and radius dressing of abrasive wheels. 35

Power Trucks

ELWELL-PARKER ELECTRIC CO., Cleveland, Ohio. Booklet A-9657, describing the use of heavy-duty die-handling trucks in metal stamping and forging plants.....36

Dust Collectors

AGET-DETROIT CO., Ann Arbor, Mich. Bulletin 510, showing typical installations of unit type dust collectors on grinding and polishing machines. 37

Band Saw

BOICE-CRANE CO., 959 W. Central Ave., Toledo 6, Ohio. Folder describing the various models and accessories of the Boice-Crane 14-inch band saw for cutting both metal and wood. 38

Welded Parts

UNITED WELDING CO., 1933 Lafayette St., Middletown, Ohio. Booklet showing typical weldments produced by the company, and pointing out the advantages of welded construction. 39

Constant-Volume Pump

SUNDSTRAND MACHINE TOOL CO., 2530 Eleventh St., Rockford, Ill. Bulletin 133, describing the new Sundstrand Model 5W constant-volume hydraulic pump.....40

Arc-Welders

HOBART BROTHERS CO., Troy, Ohio. Circular containing illustrations and brief descriptions of the various types of Hobart Multi-Range arc-welders. 41

Automatic Drilling Machine

KENT MACHINE CO., Cuyahoga Falls, Ohio. Bulletin illustrating and describing the Kent duplex horizontal drilling machine with semi- or full-automatic feed.....42

Electric Trucks

YALE & TOWNE MFG. CO., 4530 Tacony St., Philadelphia 24, Pa. Bulletin P809 (30 pages), containing information on the complete line of "Work-saver" electric trucks. 43

Drilling Machines

CANEDY-OTTO MFG. CO., Chicago Heights, Ill. Folder illustrating and describing various additions to the "Comco" line of drilling machines. 44

Hand Trucks

RAPIDS-STANDARD CO., INC., Department W-171, 342 Rapistan Bldg., Grand Rapids 2, Mich. Bulletin describing the line of "Wheel-Ezy" hand trucks. 45

Safety Drill Tables

MODERN MACHINE TOOL CO., Jackson, Mich. Circular descriptive of "Safety" drill tables designed for maintenance and miscellaneous drilling. 46

Buffing Cloth

DIVINE BROTHERS CO., 200 Seward Ave., Utica 1, N. Y. Bulletin FDB-3, showing ten samples of buffing cloths for buffing metal, wood, and plastics. 47

Safety Goggles

UNIVIS LENS CO., Dayton 1, Ohio. Pamphlet describing "Safe-T-Vis" goggles, made of an allyl casting resin plastic. 48

Used Machine Tools

J. L. LUCAS & SON, INC., Bridgeport, Conn. Catalogue listing many late-type used machine tools. 49

To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (April, 1948) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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By E.S.S.

BETWEEN GRINDS

Invitation in Earnest

The Veterans Technical Education Committee has sent us a list of Veterans Administration hospitals who have urgently requested technical literature, such as MACHINERY, for use in rehabilitating sick and disabled veterans. If you would care to help by forwarding your back copies of MACHINERY directly to one of these hospitals, please drop our Editor a line and he will send you the address of the Veterans Administration hospital nearest you that requested such literature. (The list is too long to publish, but this plan will keep your postage at a minimum and avoid duplication in the hospitals' receipt of copies.) The few minutes of your time that this good deed will consume may mean hours of occupation for these men.

More on the S. E. and H. P.

The sales department of a large New England machine tool company distributed reprints of the first article to appear in the column "The Sales Engineer and His Problems" to its sales engineers both in the field and in the home office. Attached to the reprint was a letter, from which we quote part: "We feel quite strongly that these articles deserve more than just a casual once-over lightly, and we suggest that you study them carefully and then retain them for future reference. Mr. Lester, through his many years of association with the sales engineer, has a strong basic understanding of the problems pertaining to the machine tool industry and the selling of this equipment. You will find these articles fundamentally sound, thought-provoking, and worthy of your serious consideration."

Softening the Blow

Here is a customer who consoles us on what he feels may be a criticism of our descriptive book advertisements: "Send Vols. I and II of 'Ingenious Mechanisms' and 'Gear Design Simplified.' If they are half as good as you say, maybe I can get some ideas. Don't feel bad about this statement."

Penny Trouble-Shooter

We intended to illustrate an engineering note in this issue (page 166) with a photograph which demonstrated how tiny a certain electric motor was by showing a penny beside the motor. Our engraver, however, questioned the use of a picture exhibiting an undefaced United States coin. So we telephoned New York offices of the U. S. Post Office, the F.B.I., and the U. S. Treasury, but to no avail. Then we approached the U. S. Attorney's office, who read to us over the telephone a long law applicable to the showing of coins and rendered the verdict: Until we actually infringed on the law, that office could not tell us whether or not we were wrong in publishing it, since they could not act in a judicial capacity; we would have to consult a private attorney. By that time, we had visions of court proceedings involving MACHINERY versus the U. S. Government, and quickly lost interest in the photograph. If any reader wants to see the picture, meet us in a dark corner of the editorial office—but hold on, we had better call somebody and find out about that, too.

No Deadlines Here

In the middle of February we received some promotional material from a company along with a Christmas card which began "As a greeting card this may arrive too early or too late. It takes a long time to distribute these folders. However, as we approach Christmas . . ." We stand in awe of such a bland disregard for the calendar.

Touch Typist Misses Touch

A foreign correspondent interested in the automatic flame-hardening operations at the Stearns-Roger Mfg. Co., described in the November number, did not have Stearns-Roger's address and asked MACHINERY to "put us in *tough* with them."

Now Turn to Page 135

There has been a lot of publicity about Buick's Dynaflow in newspapers and magazines, but nothing about the actual manufacture of the transmission. In this issue, we are presenting the first (we believe) technical description of the manufacturing methods involved in its production. Read how parts that make up the Dynaflow are machined to tolerances generally held only in the aircraft manufacturing industry.

News of the Industry

California

TWIN DISC CLUTCH CO., Racine, Wis., announces the opening of a new branch sales engineering office at 2950 Leonis Blvd., Los Angeles, Calif. The Los Angeles office is located in a newly constructed building, and will serve the territory including California, Arizona, and Nevada. All activities of the company on the West Coast are under the general supervision of A. E. YOUNG, district manager. PIERCE TYRRELL will have supervision over the sales functions of the California territory, and PRESTON OLNEY, formerly field service engineer at Dallas Tex., will serve as manager of the new office.

GRAYMAR CO. has been organized at 959 Crenshaw Blvd., Los Angeles 6, Calif., to handle the distribution of various products related to plant maintenance and materials handling. The founders of the company are C. P. TURNER and DAVID T. ARNOLD. Mr. Turner was vice-president and Mr. Arnold sales manager of the Airquipment Co. for several years.

JOSEPH T. RYERSON & SON, INC., have completed the construction of a new steel service plant at Emeryville, Calif., in the San Francisco Bay area. WAYNE D. DUKETTE, formerly manager of the Ryerson steel service plant in Cincinnati, Ohio, is manager of the new plant. RAY C. PAGE is sales manager.

WARNER & SWASEY CO., Cleveland, Ohio, has recently opened a Los Angeles show-room, warehouse, and western sales headquarters at 3340 Leonis Blvd., Vernon, Calif. L. R. HAWKINS, district manager in California, is in charge at the new headquarters.

Illinois and Indiana

HANNA ENGINEERING WORKS, Chicago, Ill., manufacturers of pneumatic and hydraulic cylinders, valves and riveters, have announced the opening of a direct factory office at 1609 Industrial Bank Bldg., Detroit, Mich. FRANK A. JAMES and W. J. RENAUD will be located at the Detroit office to serve industry in eastern Michigan. The company also announces the appointment of JOHN FUREY, 264 W. Brimfield Road, Wethersfield, Conn., as district representative for the New England states, and of the SCOTT EQUIPMENT & ENGINEERING CO., 612 Imo Drive, Dayton, Ohi , as representative in southern Ohio.

THEODORE C. FROEBERG has been appointed district manager for the state of Iowa and the Tri-Cities territory by the Size Control Co., Division of American Gage & Machine Co., 2500 W. Washington Blvd., Chicago, Ill. WILLIAM C. MASSOW has been appointed assistant sales manager in charge of press sales by the Walsh Press & Die Co., Division of American Gage & Machine Co., 4709 W. Kinzie St., Chicago. He was previously with the Minster Machine Co.

CLARENCE J. SMITH has been appointed chief engineer of the Hydro-Line Mfg. Co., Rockford, Ill., manufacturer of hydraulic and air cylinders and special machinery. He was previously general manager of the Process Equipment Division of W. F. & John Barnes Co., of Rockford. FRANK G. BASTABLE has been appointed sales representative in the mid-western territory for the company. Mr. Bastable is vice-president of the Rockford Automotive Industries.

CHICAGO METAL HOSE CORPORATION, Chicago, Ill., announces the purchase of the WHEELOCK MFG. CO., St. Johnsbury, Vt., which will be operated in the future as the Wheelock Mfg. Division of the corporation. This division will continue to manufacture "Stay-Put" coolant hose and flexible lamp-arm tubing at its plant in St. Johnsbury.

W. E. BYRNE has been appointed district sales manager in the Detroit area for the Simonds Abrasive Co., Philadelphia, Pa. He will also continue to hold the post of district sales manager in Chicago. His headquarters will be at the Simonds branch warehouse, 127 S. Green St., Chicago.

J. JAMES MUDD, formerly assistant sales manager of the Bellows Co., Akron, Ohio, manufacturer of "controlled-air power" devices, has been appointed regional sales manager of the Midwest Division for the company, with headquarters at Chicago.

HOWARD J. ELGIN and CHARLES H. ROPER have recently been advanced to the posts of vice-president of the Steel Sales Corporation, 3348 S. Pulaski Road, Chicago 23, Ill.

W. K. MILLHOLLAND, JR., has succeeded to the management of the W. K. Millholland Machinery Co., Indianapolis, Ind. He has been associated in the business with his father, the late W. K. Millholland, Sr., for a number of years, and has been in charge of the firm's operations during the last four months.

J. P. Vederko, Newly Appointed General Superintendent of the Cross Co.

Michigan

J. P. VEDERKO has been promoted to the position of general superintendent of the Cross Co., Detroit, Mich., manufacturer of special machine tools. He has been connected with the company since 1946. Prior to that, he was superintendent of the Machinery Division of the Ex-Cell-O Corporation for seven years.

JAMES R. SEBASTIAN was elected president of the Rapids-Standard Co., Inc., Grand Rapids, Mich., manufacturer of material-handling equipment, at a recent meeting of the board of directors. Mr. Sebastian also continues to fill the post of general manager. He succeeds LLOYD C. BACKART, who was named chairman of the board of directors and who also serves as sales manager.

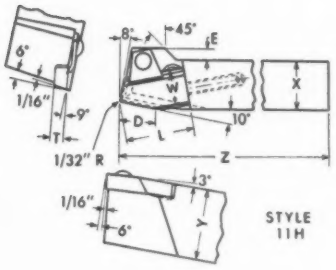
DOUGLAS STRAITH has been appointed field sales and service engineer of the Putnam Tool Co., 2981 Charlevoix Ave., Detroit 7, Mich. Mr. Straith was formerly with Republic Aircraft Division, Avco Mfg. Corporation, Detroit, Mich.

ALLEN-BRADLEY CO., Milwaukee, Wis., manufacturer of electric motor controls, announces the removal of its Detroit office to new and larger quarters at 11,100 E. Warren Ave.

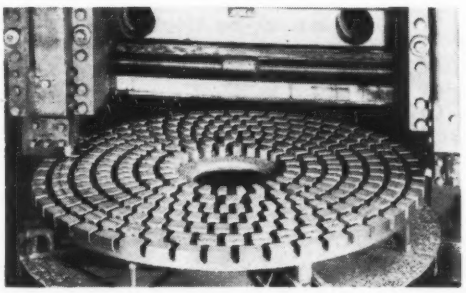
JOSEPH R. LEX has been appointed assistant general manager of the Progress e Welder Co., 3050 E. Outer Drive, Detroit 12, Mich. He joined the company early in 1946.

IF Interrupted Cuts Are Your Problem

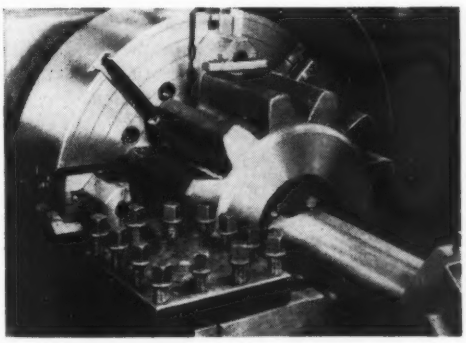
Learn About Kennametal



Style 11H is one of a complete line of Kennametal tools, having sturdy, clamped-in, advanceable Kennametal tips. This assembly—developed by Kennametal—is highly successful on interrupted cutting, and is equally outstanding on continuous-cut operations. It utilizes Kennametal's high strength to best advantage—provides a thermally-strain-free assembly; makes possible deep cuts and heavy feeds; simplifies grinding since tip is advanced and re-sharpened without removing any steel from shank; and enables practically all of the Kennametal tip to be utilized for cutting.



This iron casting has 288 chilled lump interruptions. A Kennametal standard Style 11T80 tool faces and turns it at 190 ft./min., .048" feed, and ¼" depth of cut.



Kennametal bores, turns, and faces over interruptions and sand holes on this chrome-nickel steel rack pinion. Speed—155 ft./min.; feed—.032"; depth of cut—¼" to 5/16". Performance is 5 to 1 over high speed steel tools in production and pieces per grind.

You're probably enjoying the advantages of carbide tooling on continuous-cut operations—but how about interrupted cutting?

Has this given you tool trouble, and made you resort to slower machining methods on some important jobs?

If so, Kennametal will help you solve this problem. Its ability to withstand the shock of interrupted cuts, on both cast iron and steel, has been unequalled.*

Although cutting conditions are often improved by changing the tool shape so that the shock will be imposed on a section of the tip that is stronger and better supported, it is still the carbide that must take the punishment. Here's where Kennametal has a distinct advantage.

Because of exclusive processing methods and careful control in manufacture Kennametal's impact strength is unusually high for such a hard material—as great as that of hardened alloy steels having much lower hardness and compressive strength.

Still further advantages for interrupted cutting are obtained by the use of mechanically-held tools developed by Kennametal Inc. Tips of characteristically high impact strength are securely clamped to, and firmly supported by a heat-treated steel shank, to provide an exceptionally strong strain-free assembly.

If you have had difficulty with carbide tools on interrupted cuts, let us engineer Kennametal to the solution of your particular problem.

*** Ask us to send you a set of Performance Reports that demonstrate the superior results obtained with Kennametal Tools on interrupted cutting.*

KENNAMETAL Inc.

Trade Mark Reg. U. S. Pat. Off.

LATROBE, PA.

MANUFACTURERS OF SUPERIOR CEMENTED CARBIDES AND CUTTING TOOLS THAT INCREASE PRODUCTION

Missouri

ROGER W. BATCHELDER has been appointed assistant to the president of the National Bearing Division, American Brake Shoe Co., and WILLIAM H. OLD has been named general purchasing agent. Mr. BATCHELDER, formerly general purchasing agent, will be located at the division headquarters in St. Louis, Mo. Mr. Old, formerly assistant general purchasing agent, will continue to be located at the company's headquarters, 230 Park Ave., New York 17, N. Y.

WAGNER ELECTRIC CORPORATION, 6400 Plymouth Ave., St. Louis 14, Mo., has announced the transfer of FRED PASHER from the position of manager of its Cleveland branch to that of manager of the Dallas, Tex. branch, replacing the late B. B. Pierce. ELMER GENT will replace Mr. Pasher as manager of the Cleveland branch.

LANDIS TOOL CO., Waynesboro, Pa., has appointed the K. P. WESSELING Co., 1221 Locust St., St. Louis 3, Mo., sales distributor in eastern Missouri and southern Illinois for the Landis complete line of cylindrical grinding machines.

WENDT-SONIS CO., Hannibal, Mo., has been appointed national distributor for the line of boring heads, boring tools, and accessories manufactured by the CRITERION MACHINE WORKS, Beverly Hills, Calif.

New England

MAURICE STANLEY, president of the Fafnir Bearing Co., New Britain, Conn., for the last twenty-one years, was elected chairman of the board at a recent meeting of the board of directors. He will be succeeded as president by STANLEY M. COOPER, executive vice-president. Mr. Stanley joined the Fafnir organization as sales manager in 1914. Mr. Cooper became connected with the organization in 1924, and has served as advertising manager, secretary, vice-president, and executive vice-president of the company.

HENRY F. KALWEIT is the new president of the Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn., manufacturer of industrial grinding machinery and abrasives. Mr. Kalweit, formerly controller, replaces JOHN T. KILBRIDE, who resigned. WILLIAM G. SCHULTZ has been made vice-president in charge of sales of the Machinery Division, and FRANK B. LAURICH vice-president in charge of the Grinding Wheel Division.

U. S. ELECTRICAL MOTORS, INC., Los Angeles, Calif., announces that it is expanding the Milford, Conn., plant of the company to more than double its present size. Construction is under way, and it is expected that the enlarged facilities will be completed by June, adding over 75,000 square feet of area to the capacity.

FLEXIBLE TUBING CORPORATION announces its entry into the flexible tubing field at Branford, Conn. The president and treasurer of the company is FREDERICK K. DAGGETT, formerly sales and engineering manager of the Spiratube Division, Warner Brothers Co., Bridgeport, Conn.

RICHARD F. V. STANTON, vice-president and assistant sale manager of machine tools for the Niles-Bement-Pond Co., West Hartford 1, Conn., recently resigned, and LESLIE MCARTHUR, manager of the Chandler-Evans Division, was elected a vice-president at a meeting of the board of directors.

HAROLD P. GRANGER has been named regional sales manager of the Eastern Division of the Bellows Co., Akron, Ohio, manufacturer of "Controlled-Air Power" devices. He previously had charge of the New England territory. Mr. Granger's headquarters will be in Boston, Mass.

RELTOOL CORPORATION, Milwaukee, Wis., has appointed the WALTER E. WINFREY CO., Cambridge, Mass., sales representative in eastern Massachusetts, Rhode Island, New Hampshire, and Maine for the company's line of metal-cutting tools.

A. L. GUTTERSON, J. B. JOHNSON, and C. N. SAFFORD were elected directors at a recent meeting of the stockholders of the Lovejoy Tool Co., Inc., Springfield, Vt. At the directors' meeting, held on the same day, Mr. Safford was elected president and C. E. HOPKINS, treasurer.

New Jersey

SMALL LOT STAMPING CO., 1025 W. Blancke St., Linden, N. J., has recently been established to produce custom-made stampings from steel, brass, copper, aluminum, bronze, and similar materials in small lots. The company has developed an improved "temporary tool" which is said to increase the speed on this type of work without impairing accuracy.

ROBERT M. NORTON, who was previously New York State manager of the Hanson-Van Winkle-Munning Co., with headquarters in Skaneateles, N. Y., has been transferred to the company headquarters in Matawan, N. J., where he will be engaged in promotional activities in the sale of electroplating and polishing equipment and supplies.

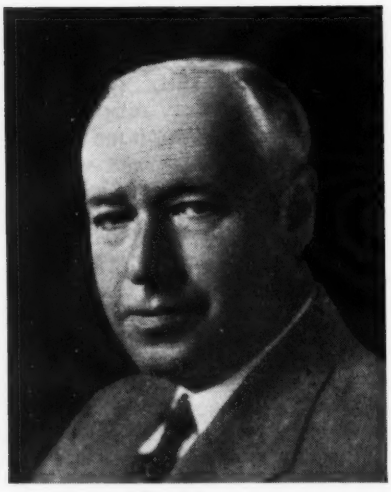
PRODUCTION TOOL SALES CO., has recently been formed by FRED E. DUERRE, with offices at 2 N. Dean St., Englewood, N. J. Mr. Duerre has been appointed representative in northern New Jersey for the REED ROLLED THREAD DIE CO., Worcester 2, Mass.

ANDREW A. PRIEST has been appointed factory manager of Thomas A. Edison, Inc., Instrument Division, West Orange, N. J.

New York

W. J. HOLTMEIER, INC., has recently been formed, with offices at 71 W. 23rd St., New York 10, N. Y., to specialize in the sale of grinding, polishing, buffing, and abrasive-belt machines. The head of the concern, Mr. Holtmeier, has been eastern manager for Hammond Machinery Builders, Inc., during the last twelve years.

FRANK W. SEIVERT has been appointed advertising manager for the Kellogg Division of the American



(Left) Maurice Stanley, Recently Elected Chairman of the Board of the Fafnir Bearing Co. (Right) Stanley M. Cooper, New President

ONE OF THESE *Time and Money Saving* SETS BELONGS IN *Your* SHOP

The Threadwell Arbor Press is recommended for use with Threadwell Keyway Cutters ⅜-G or smaller. It takes work up to 14″ dia., 15″ stroke. Hand leverage 48 to 1. Light but strong. Ask for it at your Threadwell distributor's.

You can cut any keyway in 60 seconds with one of these *Threadwell* Keyway Cutters.

All you have to do is drop in the bushing that fits the bore, put the broach in the bushing slot and press it through, once with the cutter and then again with the shim to give you the exact depth you want. One minute and you've cut a standard width keyway of any desired depth in a gear, collar, pulley hub, coupling, milling cutter, or what have you.

A *Threadwell* Keyway Cutter Set pays for itself in no time, even if you only have an occasional keyway to cut.

For complete description and prices, ask your *Threadwell* distributor or write us for Bulletin.

Like Threadwell Taps, Threadwell Keyway Cutters are sold exclusively through Mill Supply Distributors

THREADWELL DISTRICT SALES ENGINEERS ARE LOCATED IN THE FOLLOWING CITIES:

295 Hayden Street, N.W.
Atlanta 3, Georgia

4506 General Pershing Street
New Orleans 15, Louisiana

4000 York Street
Denver 5, Colorado

520 First Avenue South
Seattle 4, Washington

12800 Puritan Avenue
Detroit, Michigan

223 Plymouth Avenue
Oreland, Phila., Pennsylvania

4009 West Washington
Chicago, Illinois

Threadwell
"TOOLS OF DISTINCTION"

THREADWELL TAP AND DIE COMPANY · GREENFIELD, MASSACHUSETTS, U. S. A.

CALIFORNIA OFFICE, THREADWELL TAP & DIE CO. OF CALIF., 1322 SANTA FE AVE., LOS ANGELES 21

Brake Shoe Co., Rochester, N. Y. Mr. Seivert has served in various production and purchasing capacities since joining the company in 1941.

Fred P. Biggs, First Vice-president of Brake Shoe and Castings Division, American Brake Shoe Co.

FRED P. BIGGS has been appointed first vice-president of the Brake Shoe and Castings Division, American Brake Shoe Co., 230 Park Ave., New York 17, N. Y. He will also continue to serve as vice-president in charge of sales, both of that division and of the Southern Wheel Division, which positions he has held since 1944.

DR. A. B. KINZEL has been elected president of Union Carbide and Carbon Research Laboratories, Inc., 30 E. 42nd St., New York 17, N. Y. Dr. Kinzel is the author of numerous papers and applied mechanics. He holds many patents in these fields. At present, he is serving as director of the American Welding Society and of the American Institute of Mining and Metallurgical Engineers, chief consultant in metallurgy to the Los Alamos and Argonne Laboratories of the Atomic Energy Commission, and many other important posts.

Dr. A. B. Kinzel, Newly Elected President of Union Carbide and Carbon Research Laboratories

ANDREW J. LACOCK has been named New York district manager of sales for the Lukens Steel Co. and its divisions, By-Products Steel Co. and Lukenweld, Coatesville, Pa. Mr. Lacock will make his headquarters at 50 Church St., New York.

DALE D. SPOOR has been appointed sales promotion manager of the Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y. RUSSELL S. SCHMIDT succeeds Mr. Spoor as dealer sales manager.

SINTERCAST CORPORATION OF AMERICA, New York City, has appointed JAN M. KROL and ROBERT LANE PETTIBONE chief metallurgical engineer and research metallurgist, respectively.

Ohio

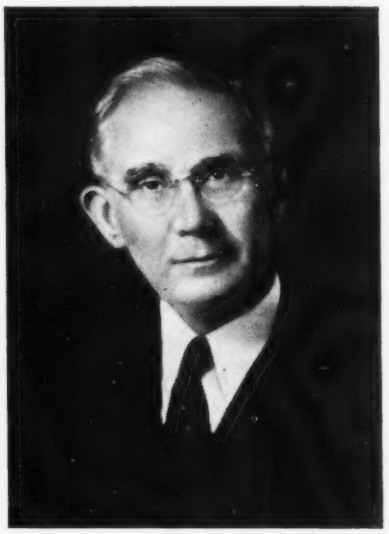
TIMKEN ROLLER BEARING CO., Canton, Ohio, announces the following organizational changes: BLAIR GLENN, general superintendent of the Canton Bearing Division, has been promoted to the position of assistant factory manager of that division, and will be succeeded as general superintendent by HENRY TOBEY. FRED BARNARD will take the post of factory metallurgist previously held by Mr. Tobey. JOSEPH SELBY succeeds Mr. Barnard as assistant factory metallurgist. RUSSELL P. FOWLER, assistant general superintendent of the Columbus plant, has been appointed superintendent of the Bucyrus bearing factory, where operations are scheduled to begin early this spring.

TYSON BEARING CORPORATION, Massillon, Ohio, has announced the following appointments: GEORGE C. MCMULLEN, vice-president in charge of sales; W. H. OEXLE, general sales manager; HERSCHEL J. DEAL, vice-president; IVAN C. MANN, assistant sales manager; R. R. FLAISIG, representative in the southern Ohio territory; E. M. SMITH, in charge of the northeastern territory, with headquarters in Philadelphia; and CARL M. BEHM, representative in northern Ohio.

TIMKEN ROLLER BEARING CO., Canton, Ohio, has leased a plant at 2300 Linden Ave., Zanesville, Ohio, which will provide 50,000 square feet of manufacturing space. Shortly after May 1, when the new quarters will be available, all operations now carried on at the company's three plants in Zanesville will be consolidated under one roof.

JOHN S. MADDEN has been appointed sales engineer and assistant electrical engineer of the G. A. Gray Co., 3611 Woodburn Ave., Cincinnati 7, Ohio. Mr. Madden spent nearly fourteen years as a sales engineer with the Westinghouse Electric Corporation, much of the time in the Cincinnati district serving the machine tool trade.

GEORGE LANGEN, who has been in the employ of the Cincinnati Planer Co., Cincinnati, Ohio, for nearly fifty years, retired on March 1. He has been with the company since 1899, when he became superintendent. In 1910, he was made work manager and a director of the company. He was elected vice-president in 1924, and upon the death of B. B. Quillen in 1945, assumed the duties of the presidency. In 1946, Mr. Langen was elected to the position of president and general manager, from which he has now retired.



George Langen, Who has Retired from the Cincinnati Planer Co. after Nearly Fifty Years of Service

PARKER APPLIANCE CO., Cleveland, Ohio, manufacturer of tube fittings, valves, and accessories for hydraulic and fluid-handling systems, announces the appointment of the following distributors: GLOBE MACHINERY & SUPPLY CO., Des Moines, Iowa, Iowa, and STANDARD BRASS & MFG. CO., Beaumont, Tex.

JOHN S. GODLEY has been appointed sales representative of the Nelson Sales Corporation, Lorain, Ohio, which handles the sales of Nelson electric-arc stud-welders. Mr. Godley,

MACHINERY'S DATA SHEETS 607 and 608

DIMENSIONAL AND CAPACITY DATA FOR TYPE M COPPER TUBING—1

Diameter, Inches			Wall Thickness, Inches	Area, Square Inches			Weight per Foot, Pounds			Circumference, Inches	
Nominal	Actual Inside	Actual Outside		of Circle with Outside Diameter	of Circle with Inside Diameter	Cross-Section of Metal	Tube	Water in Tube	Tube and Water	Outside	Inside
1/8	0.200	0.250	0.025	0.049	0.031	0.018	0.068	0.0138	0.0818	0.785	0.628
1/4	0.325	0.375	0.025	0.110	0.083	0.027	0.107	0.0363	0.1433	1.178	1.021
3/8	0.450	0.500	0.025	0.196	0.159	0.037	0.145	0.0688	0.2138	1.570	1.413
1/2	0.569	0.625	0.028	0.307	0.254	0.053	0.204	0.1100	0.3140	1.963	1.787
5/8	0.690	0.750	0.030	0.442	0.374	0.068	0.263	0.1625	0.4255	2.355	2.167
3/4	0.811	0.875	0.032	0.601	0.516	0.085	0.328	0.2238	0.5518	2.748	2.547
1	1.055	1.125	0.035	0.993	0.874	0.119	0.465	0.3794	0.8444	3.533	3.313
1 1/4	1.291	1.375	0.042	1.484	1.31	0.174	0.682	0.5688	1.2508	4.318	4.054
1 1/2	1.527	1.625	0.049	2.072	1.92	0.252	0.940	0.8331	1.7731	5.103	4.795
2	2.009	2.125	0.058	3.546	3.17	0.376	1.46	1.3456	2.8356	6.673	6.308
2 1/2	2.495	2.625	0.068	5.409	4.89	0.519	2.03	2.1225	4.1525	8.243	7.834
3	2.981	3.125	0.072	7.669	6.98	0.689	2.68	3.0294	5.7094	9.813	9.360
3 1/2	3.459	3.625	0.083	10.315	9.39	0.915	3.58	4.0750	7.6550	11.383	10.861
4	3.935	4.125	0.095	13.361	12.15	1.211	4.66	5.2300	9.8900	12.953	12.356
5	4.907	5.125	0.109	20.626	18.90	1.726	6.66	8.2031	14.863	16.093	15.408
6	5.881	6.125	0.122	29.453	25.15	2.303	8.92	11.7838	20.70	19.233	18.466
8	7.785	8.125	0.170	51.826	47.58	4.246	16.5	20.6525	37.15	25.513	24.445
10	9.701	10.125	0.212	80.463	73.88	6.583	25.6	32.0663	57.67	31.793	30.461
12	11.617	12.125	0.254	115.395	105.94	9.255	36.7	45.9806	82.68	38.073	36.477

Note: Columns 1, 3, 4, 8, 9, and 10 are from ASTM Standards; other columns are calculated.

MACHINERY'S Data Sheet No. 607, April, 1948

DIMENSIONAL AND CAPACITY DATA FOR TYPE M COPPER TUBING—2

Nominal Diameter, Inches	Length of Tube per Square Foot of Surface, Feet		Square Feet of Surface per Foot of Tube		Capacity of Tube per Foot of Length		Length of Tube, in Feet, to Contain		
	Outside	Inside	Outside	Inside	Cubic Feet	Gallons	One Cubic Foot	One Gallon	One Pound of Water
1/8	15.40	19.200	0.065	0.052	0.00022	0.00165	4545.0	606.0	72.5
1/4	10.20	11.760	0.098	0.085	0.00058	0.00435	1724.0	230.0	27.5
3/8	7.63	8.475	0.131	0.118	0.00110	0.00823	909.1	122.0	14.5
1/2	6.10	6.711	0.164	0.149	0.00176	0.01316	568.2	76.0	9.09
5/8	5.10	5.525	0.196	0.181	0.00260	0.01945	384.6	51.4	6.15
3/4	4.37	4.717	0.229	0.212	0.00358	0.02678	379.3	37.3	4.47
1	3.40	3.623	0.294	0.276	0.00607	0.04540	164.7	22.0	2.64
1 1/4	2.78	2.959	0.360	0.338	0.00910	0.06807	109.9	14.7	1.76
1 1/2	2.35	2.500	0.425	0.400	0.01333	0.09971	75.02	10.0	1.20
2	1.80	1.901	0.556	0.526	0.02201	0.16463	45.43	6.08	0.727
2 1/2	1.46	1.531	0.688	0.653	0.03396	0.25402	29.45	3.94	0.471
3	1.22	1.282	0.818	0.780	0.04847	0.36256	20.63	2.76	0.330
3 1/2	1.05	1.105	0.949	0.905	0.06520	0.48770	15.34	2.05	0.245
4	0.959	0.9708	1.080	1.030	0.08368	0.62593	11.95	1.60	0.191
5	0.746	0.7788	1.341	1.284	0.13125	0.98175	7.616	1.02	0.122
6	0.624	0.6497	1.603	1.539	0.18854	1.4103	5.302	0.709	0.085
8	0.470	0.4909	2.126	2.037	0.33044	2.4717	3.027	0.405	0.048
10	0.378	0.3940	2.649	2.538	0.51306	3.838	1.912	0.261	0.031
12	0.315	0.3291	3.173	3.039	0.73569	5.503	1.359	0.182	0.022

MACHINERY'S Data Sheet No. 608, April, 1948

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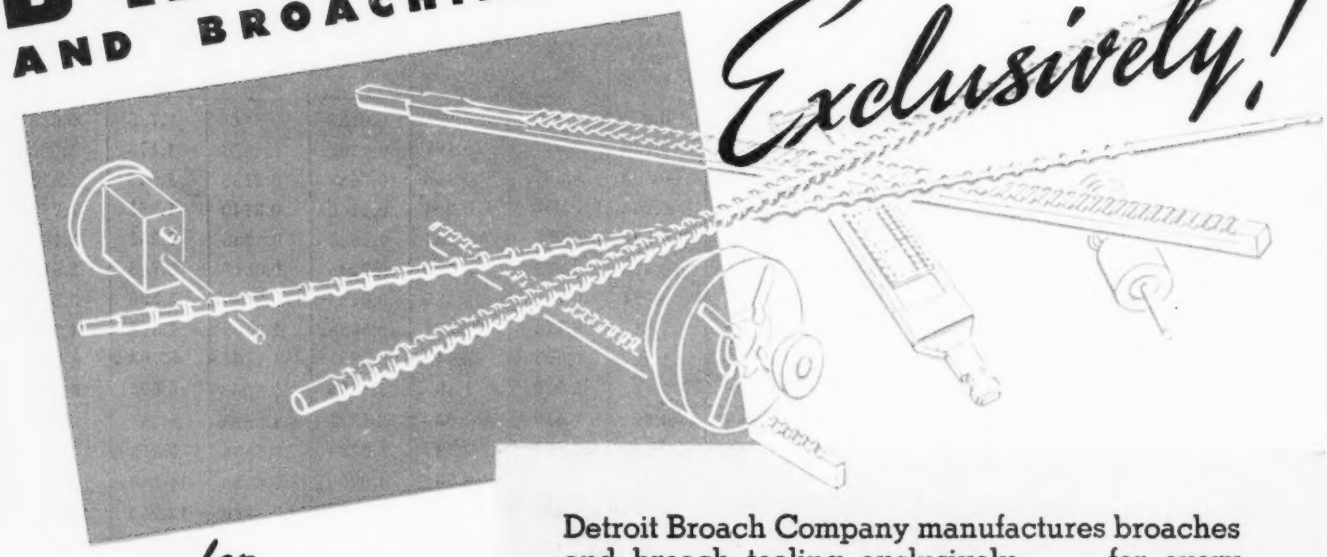

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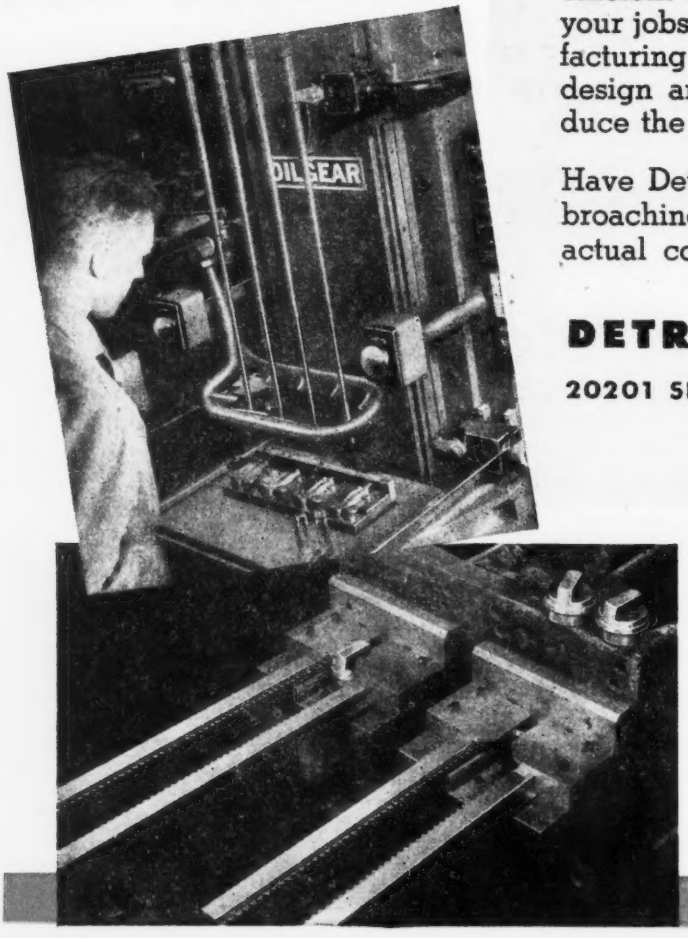
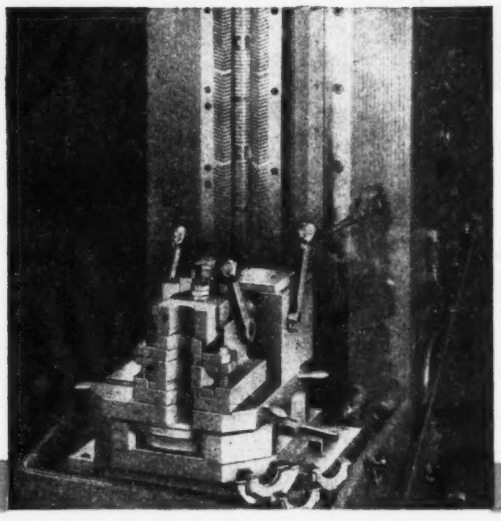




formerly in the company's Detroit office, will serve the Washington, D. C. area. R. E. McGINNIS will fill the vacancy at the Detroit office.

ROBERT H. McGRATH has been appointed assistant to Tell Berna, general manager of the National Machine Tool Builders' Association, 10525 Carnegie Ave., Cleveland 6, Ohio. Mr. McGrath was formerly vice-president and general manager of Joseph Dyson & Sons, Inc., Cleveland, Ohio, forging manufacturers.

H. E. Cable has been appointed district manager of the Pittsburgh office of the Lincoln Electric Co., Cleveland 1, Ohio, succeeding J. S. ROSCOE. Mr. Cable previously served as a welding engineer in the Pittsburgh area. Mr. ROSCOE becomes district manager of the Chicago office.

C. E. HOWES has been named manager of sales (steel equipment products) for the Berger M nufacturing Division of the Republic Steel Corporation, Cleveland, Ohio. He has been associated with the Berger sales department since 1922.

ARO EQUIPMENT CORPORATION, Bryan, Ohio, has announced the election of WALTER C. LEITCH as vice-president and general manager. Since 1921, Mr. Leitch has been associated with the Gilbert & Barker Mfg. Co., Springfield, Mass.

I. J. BARBER, director of engineering for the Fostoria Pressed Steel Corporation, Fostoria, Ohio, has been promoted to the position of vice-president.

DR. H. B. OSBORN, JR., has been appointed technical director of the Tocco Division, Ohio Crankshaft Co., Cleveland, Ohio. Dr. Osborn was formerly research and development engineer and later sales manager of the Tocco Division.

H. B. Osborn, Jr., Technical Director of Tocco Division, Ohio Crankshaft Co.

C. RICHARD NEWPHER, production manager of the Ivanhoe Division of the Reliance Electric & Engineering Co., Cleveland, Ohio, for the last two years, has now been made division manager as well.

GRINDERS AND FIXTURES, INC., have moved into a new factory at 8327 Clinton Road, Cleveland 9, Ohio, and are now in production on Cleveland circular relief grinders and universal indexing heads.

Pennsylvania and Maryland

BALDWIN LOCOMOTIVE WORKS, Philadelphia 42, Pa., announce the following changes in personnel: RAYMOND B. CREAN has been elected assistant vice-president, production. He was formerly assistant to the vice-president, operations. R. NEVIN WATT has been elected assistant vice-president, domestic sales, and ROLAND C. DISNEY has been appointed manager of domestic sales. ROBERT G. TABORS has been appointed sales manager of the Hydraulic Press and Power Tools Section of the Baldwin Locomotive Works at Eddystone, Pa. Until recently he has served as sales manager for the William H. Harman Corporation, Wilmington, Del.

SAMUEL F. NEWMAN has been elected chairman of the board and M. A. HOLLENGREEN president of the Landis Tool Co., Waynesboro, Pa., manufacturer of precision grinding machines. Mr. Newman was previously president, and has been connected with the company for forty-eight years. Mr. Hollengreen has been general manager since 1942, and will continue to fill that post, in addition to his new duties.

O. B. WILSON has been named industrial manager for the eastern sales region of the Brown Instrument Division, Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. He has previously served as a sales engineer and industrial manager, and will continue to make his headquarters in New York City, where he has served as manager for the last two years.

DR. CHARLES W. RIPPIE has joined the Lukens Steel Co., Coatesville, Pa. as a member of its sales development staff. Previously, Dr. Rippie was head of the technical service of the Research and Development Division of Merck & Co., Rahway, N. J.

E. H. PHILLIPS, formerly manager of Mine Gears and Parts Division of the Pittsburgh Gear Co., Pittsburgh

E. H. Phillips, Newly Appointed General Sales Manager of the Pittsburgh Gear Co.

22, Pa., has been appointed general sales manager. Mr. Phillips joined the sales staff in 1941.

ARTHUR S. ROBERTS has been appointed secretary and counsel of S K F Industries, Inc., Philadelphia, Pa., manufacturer of ball and roller bearings. He was previously assistant counsel.

CHARLES W. YOUNG has been appointed plant manager of the Pennsylvania Flexible Metallic Tubing Co., Philadelphia, Pa. He has been employed by the company for over twenty years.

J. P. SPAIN, formerly sales engineer at Chicago for the Black & Decker Mfg. Co., Towson, Md., has been promoted to the position of branch manager at Baltimore, Md. ARTHUR S. BOEHM, sales engineer at Pittsburgh, has been placed in charge of the San Francisco branch, succeeding A. W. HELBUSH, who has resigned.

Wisconsin

LOUIS ALLIS, JR. was recently elected vice-president in charge of sales of the Louis Allis Co., Milwaukee 7, Wis., manufacturer of electric motors. At the same time, FRANK O. KOVICH and T. R. WIESEMAN were elected, respectively, vice-president in charge of manufacturing and vice-president in charge of engineering. The other changes announced by the company are C. G. SKIDMORE, sales manager; JAMES H. DAGANHARDT, chief engineer; and JOHN J. KIRKISH, chief of electrical design.

CLINTON E. STRYKER was recently elected president of Maysteel Prod-

ucts, Inc., with plants in Mayville, Sheboygan, and Hartford, Wis., and executive and sales offices in Milwaukee. He heads a group which has purchased that company. Mr. Stryker was formerly president of the Adel Precision Products Corporation and Aerco Corporation, Burbank, Calif. Maysteel Products, Inc., will manufacture fabricated sheet-metal products and will assist customers in product design.

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis., announces the following changes in personnel: E. H. HORSTMAN and HANS P. DAHLSTRAND have been named, respectively, chief engineer and director of engineering of the steam turbine department. GEORGE H. CARDEN and T. G. SMITH have been made, respectively, manager of the Baltimore district office and representative of the company at Beaumont, Tex.

MILWAUKEE CHAPLET & MFG. CO., Milwaukee, Wis., announces that the Machinery Manufacturing Division of the company will henceforth be known as the RICE PUMP & MACHINE Co., but will continue to operate as a division of the parent company. The Rice Pump & Machine Co. manufactures the Milwaukee die filer, the Milwaukee profile grinder, and the Milwaukee-Tessmer sprue-cutter.

AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 4, Wis., announces a number of changes in its sales organization: JACK K. BYBEE has been made district manager at Detroit, and GORDON E. BROWN, district manager at Chicago. THE INDUSTRIAL INSTRUMENT Co., Millbury, Ohio, has been appointed distributor for Ampco aluminum bronze and other products in the Toledo area.

DONALD L. HERR has become associated with the engineering department of the Allen-Bradley Co., Milwaukee, Wis., and will be engaged in developing servo-mechanisms for machine tools and other equipment.

Coming Events

APRIL 5-8 — THIRD SOUTHERN MACHINERY AND METALS EXPOSITION at the Atlanta Municipal Auditorium, Atlanta, Ga. Managing director, Michael F. Wiedl, 267 E. Paces Ferry Road, N.E., Atlanta 5, Ga.

APRIL 5-8 — Fourth annual conference and exhibition of the NATIONAL ASSOCIATION OF CORROSION ENGINEERS at the Jefferson Hotel in St. Louis, Mo. Chairman of the publicity committee, W. Z. Friend, 67 Wall St., New York 5, N. Y.

APRIL 19-21—Third annual convention and exhibit of the AMERICAN SOCIETY OF LUBRICATION ENGINEERS at the Hotel Statler, Buffalo, N. Y. For further information, address the Society at its headquarters, 343 S. Dearborn St., Chicago 4, Ill.

APRIL 26-30—SEVENTEENTH ANNUAL PACKAGING EXPOSITION in the Public Auditorium, Cleveland, Ohio, under the sponsorship of the American Management Association. For further information, address Clapp & Poliak, Inc., 350 Fifth Ave., New York 1.

MAY 3-7—Annual meeting and foundry exhibit of the AMERICAN FOUNDRYMEN'S ASSOCIATION in Philadelphia, Pa. Secretary-treasurer, WILLIAM W. MALONEY, 222 W. Adams St., Chicago 6, Ill.

MAY 27-29—Annual meeting of the SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS at the Roosevelt Hotel in Pittsburgh, Pa. Secretary-treasurer, W. M. Murray, P. O. Box 168, Cambridge 39, Mass.

JUNE 21-25 — Annual meeting and exhibit of the AMERICAN SOCIETY FOR TESTING MATERIALS in Detroit, Mich. Society headquarters, 1916 Race St., Philadelphia 3, Pa.

JUNE 28-JULY 1—Annual convention and Industrial Finishing Exposition of the AMERICAN ELECTROPLATERS SOCIETY in the Convention Hall, Atlantic City, N. J. National office of the Society, Jenkintown, Pa.

AUGUST 10-13—First WESTERN PACKAGING EXPOSITION AND CONFERENCE ON PACKAGING, PACKING, and SHIPPING at the Civic Auditorium, San Francisco, Calif. Sponsored and managed by Clapp & Poliak, Inc., Empire State Bldg., New York 1, N. Y.

SEPTEMBER 13-17 — THIRD INSTRUMENT CONFERENCE AND EXHIBIT under the sponsorship of the Instrument Society of America, Pittsburgh 12, Pa., in Convention Hall, Philadelphia, Pa.

OCTOBER 11-13 — Sixteenth annual convention of the NATIONAL LUBRICATING GREASE INSTITUTE at the Edgewater Beach Hotel, Chicago, Ill. Executive Secretary, Carl E. Bolte, 4638 Mill Creek Parkway, Kansas City 2, Mo.

NOVEMBER 4-6 — Annual Technical Forum of the NATIONAL ELECTRONICS CONFERENCE, INC., at the Edgewater Beach Hotel, Chicago, Ill., under the joint sponsorship of the Illinois Institute of Technology, Northwestern University, American Institute of Electrical Engineers, Institute of Radio Engineers, and the University of Illinois. Further information can be obtained from J. A. M. Lyon, Northwestern Technological Institute, Evanston, Ill.

Obituaries

Jack C. Carlton

Jack C. Carlton, president of the Carlton Machine Tool Co., Cincinnati, Ohio, died on February 2 at the age of sixty-nine years. Mr. Carlton was born on June 6, 1878. He entered the machine tool industry in his early boyhood, and after being associated with the American Tool Works, Bradford Machine Tool Co., Bickford Tool Co. and Lodge & Shipley Co., he headed a group that purchased the William E. Gang Co. and established the present company, the Carlton Machine Tool Co. During the years 1912 to 1916, while Mr. Carlton was sales manager for the Lodge & Shipley Machine Tool Co., he traveled extensively in Europe. Mr. Carlton's forceful and kindly personality won him a host of friends.

Patrick J. Flaherty

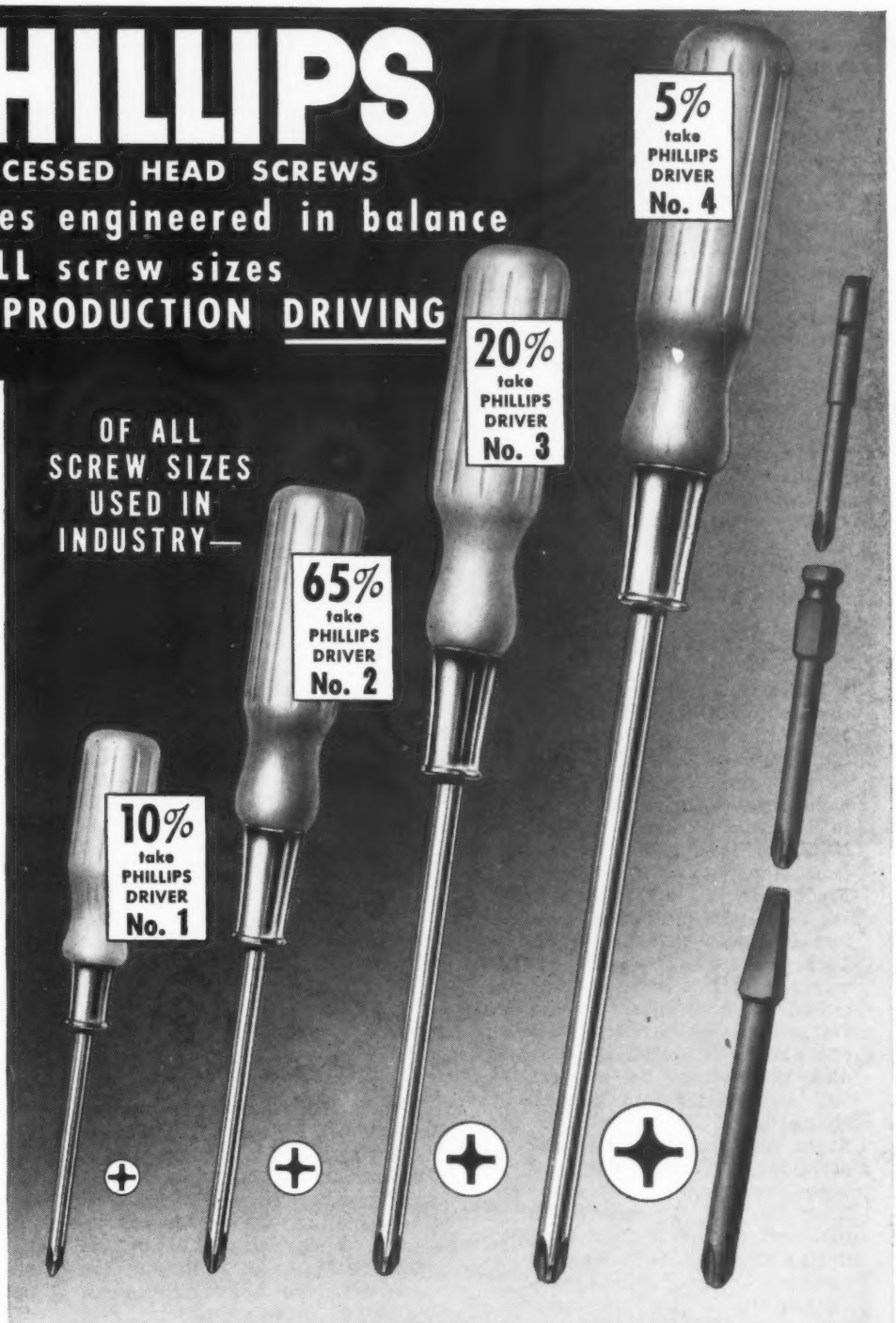
Patrick J. Flaherty, chairman of the board of directors of the Johnson Bronze Co., New Castle, Pa., died suddenly in the Alton Road Hospital at Miami Beach, Fla., on February 12.

Mr. Flaherty was born in Ireland in 1879. As a boy, he was brought to Boston, Mass., by his parents, and later the family moved to Verona, Pa. (a suburb of Pittsburgh), where he was reared. A self-educated man, he mastered the intricacies of accounting by home study, and in 1909, became accountant for the old American Car and Ship Hardware Co., a small plant manufacturing various types of hardware and spun brass parts. In a short time, he was operating the company. In 1912, when the automobile industry was beginning to expand, he was asked

Only PHILLIPS

RECESSED HEAD SCREWS

have driver sizes engineered in balance with ALL screw sizes for PRACTICAL PRODUCTION DRIVING



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Phillips Practical Engineering, based on exhaustive tests of actual driver requirements on the assembly job, proved 4 sizes of recesses and drivers the fewest possible for dependable efficiency in driving the complete range of sizes of cross recessed head screws.

One Driver Size is adequate for most jobs, however, because the great majority of production assemblies use screws in the Phillips No. 2 recess and driver size range.

About 25% of Screws used in production assemblies are bigger than those in the popular No. 2 size range. 20% have Phillips No. 3 size recess, and the proper balance essential to efficient driving is provided by the Phillips No. 3 size driver.

For the Few Heavy Duty screws used, (5%), you need a driver and recess size balanced to obtain the required torque and fastening security, — Phillips No. 4. Using a driver suited to smaller screws is like using a tack hammer on a railroad spike.

For Small Size Screws, you want a small driver (No. 1) in proper *balance* to prevent overdriving, stripping threads, or straining screw head. You wouldn't use a driver big enough to drive a ½" diameter screw, any more than you'd use a sledge hammer to drive a tack.

Phillips Screws not only promise, but *deliver* all the advantages of cross recessed head screws. Ask for Phillips when you order.

DRIVERS AND BITS SHOWN HALF SIZE — RECESSES ACTUAL SIZE

THE PHILLIPS DRIVER AND SCREW are in perfect balance, whatever the size. Less than 4 recess and driver sizes would have meant weakened heads in some screw sizes — would have encouraged overdriving to weaken the screw, or underdriving to lessen assembly strength.

By varying the length and diameter, the same balance is assured in bits for hand brace, spiral, and power driving.

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Central Screw Co.
Continental Screw Co.
Corbin Screw Div. of American Hdwe. Corp.
Elco Tool & Screw Corp.
The H. M. Harper Co.
Lamson & Sessions Co.
Milford Rivet and Machine Co.
National Lock Co.
National Screw & Mfg. Co.
New England Screw Co.
Parker-Kalon Corporation
Pawtucket Screw Co.
Pheoll Manufacturing Co.
Reading Screw Co.
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Manufacturing Co.
Seaboard Screw Corp.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
Stronghold Screw Products, Inc.
Wales-Beech Corp.
Wolverine Bolt Company

M-28

by a concern in that field if his company could manufacture bearings for automobiles. Although without previous experience in this line, Mr. Flaherty immediately installed machinery for the purpose, and was soon producing bronze bushings and bearings. From this small beginning, the Johnson Bronze Co. expanded, in pace with the automobile industry, until it now employs 2000 men and women.

During both world wars, the company was engaged in manufacturing for war purposes. In 1928, Mr. Flaherty became the principal owner of the business. For many years he was president of the company, later relinquishing this post to his son, J. Preston Flaherty, and becoming chairman of the board.

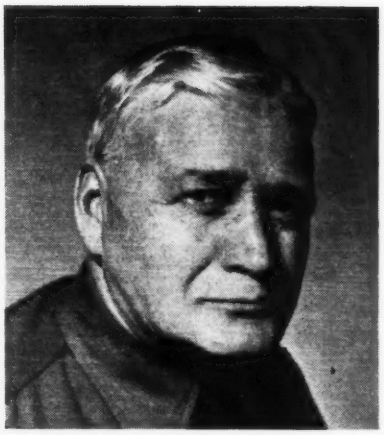
Occupied though he was with his business affairs, Mr. Flaherty took time to aid in civic and welfare projects. Surviving him are his widow, three sons, and a daughter.

James H. McGraw, Sr.

James H. McGraw, Sr., founder of the McGraw-Hill Publishing Co., Inc., New York, died on February 21 in San Francisco, Calif., after an illness of several years, at the age of eighty-eight years. Mr. McGraw was born in Panama, Chautauqua County, N. Y., in 1860, and was graduated from the State Normal School, Fredonia, N. Y., in 1884. After teaching for a year, he joined the American Railway Publishing Co. of New York, publisher of "The Street Railway Journal," in which he later acquired the controlling interest. In 1916, when John A. Hill, publisher of a number of industrial magazines, died, the McGraw Co. acquired the Hill publications and formed the McGraw-Hill Publishing Co., Inc. Seven years earlier, the book departments of the two companies had been merged as the McGraw-Hill Book Co. Mr. McGraw served as president of the McGraw-Hill Publishing Co. until 1928, when he became chairman of the board of directors. Upon his retirement in 1935, he was elected honorary chairman, and was succeeded as chairman by his son James H. McGraw, Jr. He is survived by his wife, four sons—James H. McGraw, Jr., Harold, Curtis W., and Donald McGraw—and a daughter, Mrs. John E. Osmun.

Carl L. Mattison

Carl Lawrence Mattison, president of the Mattison Machine Works, Rockford, Ill., died on March 3, in his Laguna Beach, Calif., home after a heart attack, at the age of sixty-one years. He was born on March 17, 1886, at Minneapolis, Minn., where his father had settled after coming to this country from Norway in 1870. In 1895, his family moved to Beloit, Wis., where in 1897, his father founded the C. Mattison Machine Works, manufacturing metal-working machines, woodworking machines, and similar equipment.



Carl L. Mattison

After graduating from the Armour Institute of Technology, Mr. Mattison became active in his father's business, along with his brother, A. M. Mattison. In 1918, due to the expansion of the business, a larger factory was built in Rockford, the father, Chris Mattison, continuing as president although he had retired from active management in 1910. Upon his death in 1920, A. M. Mattison became president. When his brother died in 1938, C. L. Mattison succeeded him, becoming president in 1939. His widow and three sons survive him.

Everard Stubbs

Everard Stubbs, former factory manager of the Fellows Gear Shaper Co., Springfield, Vt., died in Eustis, Fla., on March 11 at the age of sixty-six years. Mr. Stubbs was born in England, and served his apprenticeship there. He came to the United States in 1910 to join the Lodge & Shipley Co. in Cincinnati. In 1912, he became connected with the Fellows Gear Shaper Co., in the capacity of superintendent, and in 1930, was appointed factory manager.

Mr. Stubbs was a member of several technical societies, and was very active on committees on industrial education, having been chairman of the National Machine Builders' Industrial Education Committee, a member of the New England Advisory Council for Training Within Industry, and a member of the Vermont State Apprenticeship Council. He retired from his duties as factory manager in 1944, due to illness, but continued to act in an advisory capacity to the engineering department.

William K. Millholland, Sr.

William K. Millholland, Sr., founder of the W. K. Millholland Machinery Co., Indianapolis, Ind., died on February 2, after an extended illness, at the age of sixty-three years. A designer and manufacturer of special production machinery, Mr. Millholland was a pioneer in the development of self-contained power units. He had been associated with the machine tool industry for more than forty years.

HARRY W. READE, apparatus sales manager for the Air Reduction Sales Co., New York, died suddenly on February 15 at Jersey City, N. J., aged fifty-six years. During thirty-three years of continuous service with the company, he held managerial positions both in Chicago and in New York. He was active in both the International Acetylene Association and the American Welding Society. During the war, he served on the War Production Board as chairman of the Committee of Welding and Cutting Division.

KENNETH N. COOK, assistant sales manager of the Rollway Bearing Co., Inc., Syracuse, N. Y., died on March 5. He had been with the company since 1927.

New Books

TOOL STEEL SIMPLIFIED. By Frank R. Palmer and George V. Luerssen. 564 pages, 6 by 9 inches. Published by the Carpenter Steel Co., Reading, Pa. Price, $2 in the United States; $2.50 elsewhere.

Great advances have been made in the manufacture and heat-treatment of tools since the original edition of this book was published, ten years ago. New and improved steels have appeared and new types of heat-treating methods and equipment have been developed. In order to provide tool and die steel users with the latest information on this subject, a second edition of this toolmaking handbook has now been brought out. Much of the material presented in this edition has never before been published. Included in the new material are chapters on hardenability of tool steels and the latest hardenability tests; atmosphere control and quenching methods; the Tool Steel selector; time required to heat tool steel; and high-speed and hot-work steels. The book is written in simple, non-technical language; its purpose is to help shop men select the right steel for each job, simplify heat-treating, reduce tool failures, and save time and effort.